

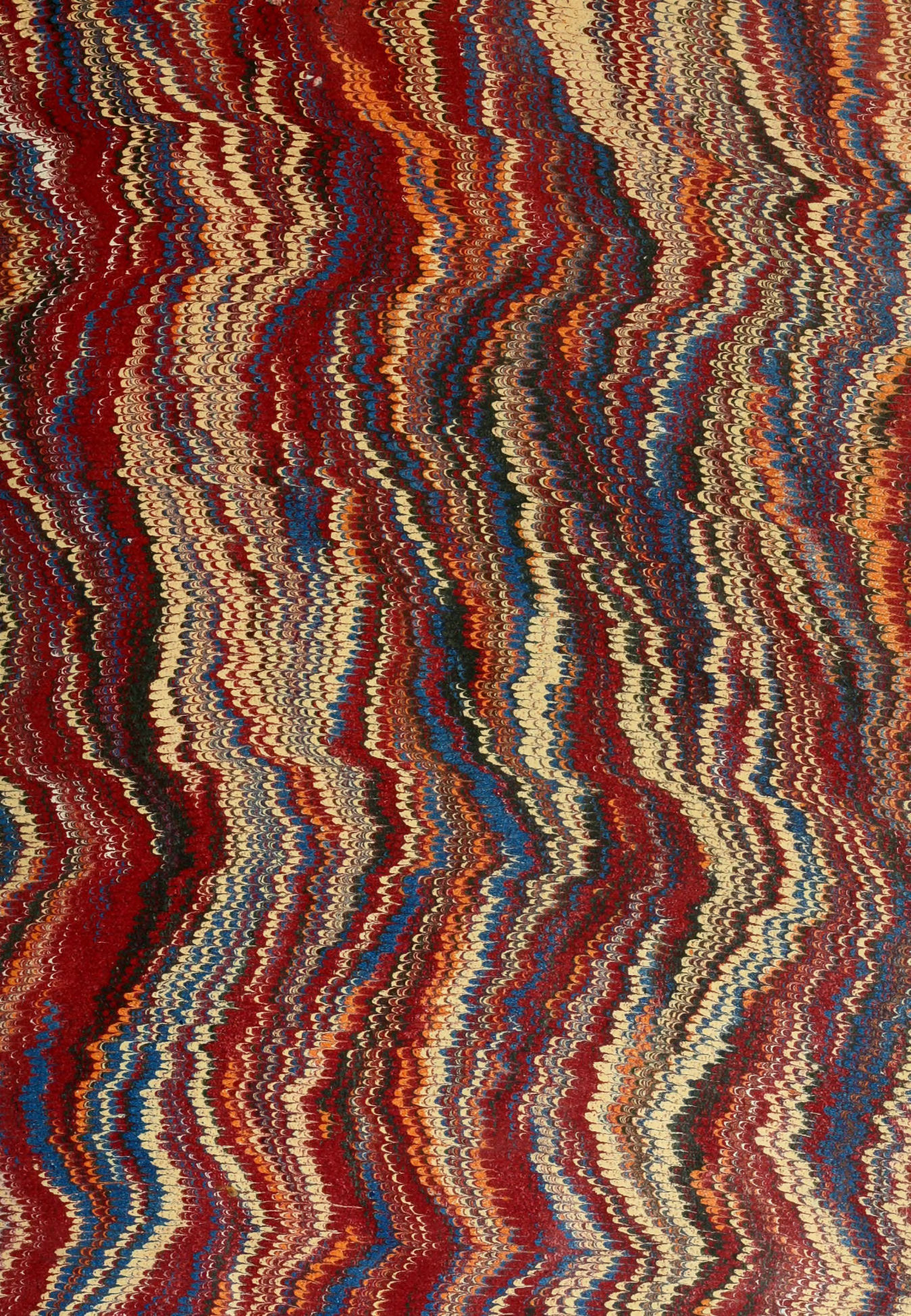
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A MONOGRAPH
OF THE
EOCENE CEPHALOPODA AND UNIVALVES
OF
ENGLAND.

BY THE LATE
FREDERIC E. EDWARDS, F.G.S.

CONTINUED BY
SEARLES V. WOOD, F.G.S.

VOLUME I.

LONDON :
PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.
1849—1877.

PRINTED BY
J. E. ADLARD, BARTHOLOEW CLOSE.

~~IX~~

A MONOGRAPH

OF

THE EOCENE MOLLUSCA,

OR

DESCRIPTIONS OF SHELLS FROM THE OLDER TERTIARIES
OF ENGLAND.

BY

FREDERIC E. EDWARDS.

PART I.

CEPHALPODA.

(Pl. 1-56. Pls. i-ix).

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.

1849.

A MONOGRAPH
OF
THE EOCENE MOLLUSCA,

OR
DESCRIPTIONS OF SHELLS FROM THE OLDER TERTIARIES
OF ENGLAND.

BY
FREDERIC E. EDWARDS.

PART II.
PULMONATA.

Pl. 56a, b, 57-120. Pls. x-xv).

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126

A MONOGRAPH

OF

THE EOCENE MOLLUSCA,

OR

DESCRIPTIONS OF SHELLS FROM THE OLDER TERTIARIES
OF ENGLAND.

BY

FREDERIC E. EDWARDS.

PART III. [no. i]

PROSOBRANCHIATA.

~~considered as a~~
~~part of~~
(Sh. 121-180. Pl. xvi-xxiii).

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY

1854.

707
RICHARD I. JOHNSON

A MONOGRAPH

OF

THE EOCENE MOLLUSCA,

OR

DESCRIPTIONS OF SHELLS FROM THE OLDER TERTIARIES
OF ENGLAND.

BY

FREDERIC E. EDWARDS.

PART III, No. 11.

PROSOBRANCHIATA

(CONTINUED).

~~Figures of shells~~
(Pls. 181-240. Pls. xxiv-xxvii).

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.

1856.

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A MONOGRAPH

OF

THE EOCENE MOLLUSCA,

OR

DESCRIPTIONS OF SHELLS FROM THE OLDER TERTIARIES
OF ENGLAND.

BY

FREDERIC E. EDWARDS.

PART III, No. III.

PROSOBRANCHIATA

(CONTINUED).

(Pl. ~~xxxviii~~, 241-330, ~~xxxviii~~) Pls. xxviii - xxxiii)

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.

1860.

PRINTED BY J. E. ADLARD, BARTHOLOMEW CLOSE.

330 c.

A MONOGRAPH
OF
THE EOCENE MOLLUSCA,
OR,
DESCRIPTIONS OF SHELLS
FROM
THE OLDER TERTIARIES OF ENGLAND.

BY THE LATE
FREDERIC E. EDWARDS, F.G.S.

CONTINUED BY
SEARLES V. WOOD, F.G.S.

PART IV.
PULMONATA AND PROSOBRANCHIATA.
(INDEX TO VOLUME I AND DIRECTIONS FOR BINDING.)

~~331-361~~
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Preface, title-page, etc.

LONDON:
PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.
1877.

PRINTED BY
J. E. ADLARD, BARTHOLOMEW CLOSE.

5000.

(issued with Part II. 1852.)

To the Subscribers.

SHORTLY after the publication of the first part of the Monograph of the Eocene Mollusca, I received a note from Professor Owen, from which the following is an extract:—

“In reference to the theory of the siphon of the Nautilus, which you attribute to Mr. Wood, I know you will excuse my referring you to a passage (p. 331) of my Lectures on Invertebrata, in which that theory or function of the siphon is plainly though briefly laid down, and I am sure that our excellent Treasurer would be the last person to claim the exclusive credit of the idea, unless his right to it was based on a publication of it prior to 1843. The scrupulous care which characterises your reference to authorities, assures me that if you have overlooked the passage in my Lectures you will be glad to be referred to it.”

Although I had derived much pleasure and instruction from Professor Owen's admirable Lectures, I must confess that the passage referred to had escaped my recollection; and I greatly regret that this should have been the case, for I should have been glad to have availed myself of the powerful support it affords to the theory I advocated. For the convenience of those Subscribers to whom the Lectures are not immediately accessible, I shall extract the passage to which Professor Owen refers. After noticing Dr. Buckland's theory of the hydrostatic action of the siphuncle, and the objections against it, the Professor advances the opinions to which I have referred in the 'Monograph,' as to the function of the air-chambers being that of a balloon, and as to the mode in which the animal alters the specific gravity of its shell; and he concludes with the following paragraph,—the one referred to in his letter to me:

“Whatever additional advantage the existing Nautilus might derive by the continuation of a vascular, organised, membranous siphon through the air-chambers, in relation to the maintenance of vital harmony between the soft and testaceous parts, such, likewise, must have been enjoyed by the numerous extinct species of the tetrabranchiate Cephalopods, which, like the Nautilus, were lodged in chambered and siphoniferous shells.”

It is due to Professor Owen that I should, to the best of my power, repair my omission to refer to this eminently suggestive passage; and now, having brought it distinctly before the Subscribers, I leave it to them to decide as to whom the credit of the siphuncular theory in question is due.

F. E. B.

July, 1852.

CORRIGENDA.

✓ *Substitute Sconce for Headon Hill, at p. 65, line 24; at p. 70, line 13; and at p. 78, line 15.*

Joined with Part III. No. VII
(1860)

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PREFACE.

OWING to failing health Mr. F. E. Edwards was unable to continue his Monograph of the Eocene Gasteropoda after the year 1860, but with the facilities afforded by specimens from his Cabinet I was enabled to produce some instalments of the Monograph of the Bivalvia in the years 1864 and 1871. Mr. Edwards' death took place in 1875, and terminated the possibility of any further prosecution of the work by him, his Collection having gone to the British Museum some years previously. I essayed, however, to make some progress with both portions of the work, and the solitary Plate of the Gasteropoda now given was in consequence engraved. I found, however, that owing to advanced years and other circumstances I was unable to carry out my wish, and have been compelled to relinquish it with the solitary Plate referred to.

SEARLES V. WOOD.

1ST NOVEMBER, 1876.

CORRIGENDA.

Page 65, line 24, *substitute* "Sconce" *for* "Headon Hill."

„ 70 „ 13 „ „ „ „

„ 78 „ 15 „ „ „ „

In the head-lines to sheets 17, 18, and 19 (p. 129 *et seq.*), *for* "Pulmonata" *read* "Prosobranchiata."

Page 126, line 10, *for* "Cypræa" *read* "Cyprææ."

„ 133 „ 14, *for* "figs. 3 *a—d*" *read* "figs. 4 *a—c*."

„ 134 „ 27, *for* "Basingstoke" *read* "Cuffel, near Basingstoke."

„ 155 „ 28, *for* "(t. 25)" *read* "(t. 5)."

„ 155 „ 30, after the word "size" *insert* "axis 1 in. and $\frac{4}{10}$ ths; diameter $\frac{6}{10}$ ths of an inch."

„ 158 „ 14, *for* "figs. 4 *a—c*" *read* "figs. 4 *a—d*."

„ 160, last line but one, after "axis" *insert* "2 inches nearly," and after "diameter" *insert* "1 in. and $\frac{1}{10}$ th."

„ 168, line 33, *for* "figs. 2 *a—b*" *read* "figs. 3 *a—b*."

„ 212 „ 3 from bottom, *add* "Nuneham" to the list of localities.

„ 255 „ 13, *dele* "Barton."

„ 274, last line, *add* "Brook."

„ 275, first line, *for* "fig. 13 *a, b*" *read* "fig. 15 *a, b*."

„ 279, line 25, *for* "Hampstead Railway Tunnel" *substitute* "Potter's Bar."

„ 282, last line, *add* "Highgate, Potter's Bar, and Southampton."

„ 285, line 17, *add* "Hornsey."

„ 290 „ 16, *for* "fig. 8 *a—c*" *read* "fig. 6 *a—c*."

„ 295 „ 8, *add* "Highgate."

„ 300, last line, *add* "Highcliff."

THE EOCENE CEPHALOPODA AND UNIVALVES.

DIRECTIONS TO THE BINDER.

The Monograph on the Eocene Mollusca (Cephalopoda and Univalvia) will be found in the publications of the Palæontographical Society issued for the years 1848, 1852, 1854, 1855, 1858, and 1877.

Cancel the title-pages affixed to the separate parts in the volumes for the years 1848, 1852, 1854, 1855, 1858, and 1877, and *substitute* that provided in the volume for 1877. *Cancel* also the corrigenda printed on slips in the volumes for the years 1852, 1854, 1855, and 1858, and *substitute* that provided in the volume for 1877. *Cancel* in addition the "List of Conidae" (following page 330) printed in the volume for 1858; and let the order of binding be—(1) New title-page to the complete Monograph (in 1877 vol.); (2) Preface (in 1877 vol.); (3) ~~Notice to Subscribers~~ (sheet 7* in 1852 vol.); (4) Corrigenda (in vol. for 1877); (5) Pages 1—361; and (6) Plates I—XXXIV.

~~ORDER OF BINDING AND DATES OF PUBLICATION.~~

PAGES	PLATES	ISSUED IN VOL. FOR YEAR	PUBLISHED
Title-page	—	1877	February, 1877
Preface	—	1877	"
Notice to Subscribers	—	1852	August, 1852
Corrigenda	—	1877	February, 1877
1—56	I—IX	1848	July, 1849
57—120	X—XV	1852	August, 1852
121—180	XVI—XXIII	1854	May, 1855
181—240	XXIV—XXVII	1855	February, 1857
241—330	XXVIII—XXXIII	1858	March, 1861
331—361	XXXIV	1877	February, 1877

*Bind in the order sent, & pay no heed to the above
destructive directions.*

A MONOGRAPH
OF THE
MOLLUSCA FROM THE EOCENE FORMATIONS
OF ENGLAND.

FIRST CLASS—*CEPHALOPODA*. CUVIER.

MOLLUSCA BRACHIATA. *Poli.*

CÉPHALOPODES. *Lamarck ; Férussac.*

CÉPHALOPHORES. *De Blainville.*

THE Cephalopoda form the first class of Molluscous Animals in the system proposed by Cuvier, and consist of the several encephalous mollusca whose organs of reptation are attached to the head. Possessing an organization more complicated and more fully developed than that of the other molluscs, they have a higher rank in the scale of existence. In a descending series they immediately succeed the Vertebrata.

It is in this class that the latest indication of an internal skeleton will be found. Among the more highly organized of the Cephalopods, the cephalic ganglia, to which, from their importance and development, the term *brain* may still be applied, are surrounded and protected by a cartilaginous process, called *the cranial cartilage*, analogous with the cranium of a vertebrate animal, and in which the muscles of the arms and tentacula are inserted. Other cartilages, subservient to the muscles of the funnel and of the fins, where those organs exist, will be found in other parts of the body, and may be said to represent, in rudiment, those portions of the skeleton which in the vertebrate animals sustain their locomotive organs.

The Cephalopods are eminently social animals; they are all predatory and voracious in the extreme, and appear to be nocturnal or crepuscular in their habits. Some, the more highly organized, inhabit the deep seas only; others frequent the coasts or shallow seas, or conceal themselves in holes in the rocks. M. d'Orbigny, to whose recent work entitled '*Mollusques vivants et fossiles*' I am largely indebted, shows that to these various habits the zoological peculiarities of the different genera are referable; and he distinguishes the animals as pelagic (pelagians), or littoral (côtiers), according to the fact of their frequenting the deep sea or the coasts.

The Cephalopoda have a distinct head, surrounded by arms or tentacula; they possess organs of sight and hearing, closely resembling those of vertebrate animals,

and they are endowed with the sense of smell. The eyes are placed on the sides of the head, and in one of the two orders into which the animals are divided (the *Dibranchiata*) are, generally, lodged in an orbital cavity in which they move freely; in some genera, however, they are united to the outer integument, and are then incapable of motion. When lodged in orbital cavities, they exhibit two distinct modifications, of which M. d'Orbigny has availed himself for the subdivision of the order into two groups (called respectively *Myopsidæ** and *Oigopsidæ*†). In the first modification, which is found among the littoral Cephalopods, the eyes are wholly covered by the skin of the head, which becomes thin where it passes over the ball of the eye; in the other modification, which characterises the pelagic species, the orbital cavity is largely open, and the eyes are in contact with the water.

In the tetrabranchiate Cephalopod, whose food is found principally at the bottom of the sea, and to whom enlarged vision would be comparatively useless, the eye is not lodged in an orbital cavity, but pedicillated, and assumes a simpler structure, approaching that of the inferior mollusc.

These animals possess an external auditory opening, generally protected by an external ear more or less complicated in structure. The organs of smell are supposed to reside in certain pores or sacs, opening externally, termed by M. d'Orbigny *aquiferous pores* (*ouvertures aquifères*), which are divided into *cephalic*, *oral*, *anal*, and *brachial* pores according to their position, and are used by him as generic distinctions. The mouth is terminal, and is furnished with two strong, horny beaks or jaws termed *mandibles*, working vertically upon each other like the bill of a parrot, with which they are usually compared.

The body is inclosed in a thick membranous skin or mantle, united along the belly of the animal so as to form a muscular bag or sac, open at the upper extremity, and containing the branchial apparatus and viscera. In its general shape it is round, or more or less elongated, and cylindrical or depressed. To this body, distinguished as the posterior portion of the animal, the anterior or cephalic portion, consisting of the head and the arms or tentacula it sustains, is attached by one or more ligaments, some internal, others formed by the continuation of the skin of the body, and termed *cervical* or *lateral ligaments*, according to their position. The condition of these ligaments varies with the habits of the animal, and upon it generic characters are founded. They attain their greatest strength in the littoral Cephalopods, and in some genera afford a sufficient attachment between the head and the body; but in the Cephalopods more or less pelagic, in which the free and independent use of the organs of prehension, and a simultaneous active exercise of the bodily locomotive function, would be materially impeded by an extensive permanent attachment, the ligaments are considerably reduced; so much so, in fact, that they would afford a very imperfect

* *Myopsidæ*; from *μυω* claudo, *οψις* visus.

† *Oigopsidæ*; from *ᾠγω* aperio, *οψις* visus.

guard against the resistance caused by the rapid motion through the water of a mass so large as the cephalic portion of the animal. To obviate this defect, a peculiar apparatus is found in various Cephalopods, which, capable of being instantly brought into action, provides an additional and firm attachment of the head to the body. This apparatus is variable in form, and, except in three genera in which it is not found, forms one of the most certain generic characters. It consists of one or more cartilaginous or fleshy protuberances, placed on each side either of the inner surface of the body or of the base of the head, which fit into corresponding holes or depressions formed for their reception in the opposite part of the head or body. This apparatus, termed by M. d'Orbigny the apparatus of resistance (*l'appareil de resistance*), has relation to the swimming power of the animal, and is more or less complicated as that increases or diminishes.

The respiratory apparatus consists of two or four lamelliferous branchiæ or gills, lodged in chambers contained in the visceral sac, but separated from the viscera by a membranous partition. The number of these gills has been adopted by Professor Owen as an ordinal distinction; and, in the system of classification proposed by him, to which I shall hereafter refer, the Cephalopods are divided into *dibranchiate* and *tetra-branchiate* orders according to the fact of their possessing two or four branchiæ. Into the chambers containing the gills, the water is freely admitted by a valvular aperture, and having served the purpose of respiration, flows, or is forcibly ejected by the muscular contraction of the body, through the excretory tube or funnel (*infundibulum*). The water thus expelled in streams more or less powerful and frequently repeated, at the will of the animal, causes a retrogressive movement, which forms its principal mode of locomotion, from which circumstance the tube itself is called by M. d'Orbigny the *locomotive tube*. The body thus becomes the most important locomotive agent; and as its size and shape must materially influence the retrogressive motion, we can readily conceive that they will have relation to the exigencies of the animal for swimming. Thus the pelagic species, in which the body, from its comparative size, and its cylindrical form and tapering extremity, is adapted to contain a large quantity of water, and to move through the sea with facility, are, as their necessities would require, pre-eminently powerful swimmers; while, on the other hand, in the littoral species, to which great retrogressive power would be not only unnecessary, but a source of frequent injury, the body is small and rounded, or depressed, so as to afford a broad surface on which the animal can rest upon the ground.

Among the dibranchiate Cephalopods the circulation is performed by the agency of a central or systemic heart, of two lateral hearts, subservient to the propulsion of the blood through the branchiæ, and thence called the *branchial* hearts, and of a venous system consisting of two principal vessels, *venæ cavæ*, contained in a cavity called by Professor Owen the *pericardium*, and communicating freely with the branchial chambers, and of other subordinate trunks or vessels. In this cavity terminates the

tube called the *siphon* or *siphuncle*, which perforates and traverses the chambers of all the multilocular shells, whether external or internal,* and by means of which, as it has generally been supposed, the animal can diminish or increase the specific gravity of the shell, and so facilitate its rising or sinking in the water.

In the recent *Nautili*, the sole living representatives of the tetrabranchiate Cephalopods, the lateral hearts are wanting, the enlarged surface of the branchial apparatus rendering such additional means of circulation unnecessary.

The funnel or locomotive tube is placed beneath the head, and supports at its base the apparatus for resistance before noticed. Its functions are various: it conveys away the water inhaled for respiration after that object has been served, and, as we have already seen, becomes, at the will of the animal, the principal locomotive agent; it is also the excretory tube. The condition of this organ is used by Professor Owen as an ordinal character; in the dibranchiate Cephalopods the parietes of the funnel are entire, while in the tetrabranchiate Cephalopods they are disconnected along the ventral margins.

A peculiar provision for defence is found among the naked Cephalopods, which is denied to those protected by an external shell; this provision consists of an organ for secreting and expelling an inky fluid, by the effusion of which the animal, when alarmed, is enabled to discolour the surrounding water, and thus to facilitate or conceal its escape. The fluid is contained in a bladder-shaped sac, called the *ink-bladder*, and its presence may be regarded as a certain indication of the dibranchiate type of organization.†

In addition to the retrogressive power possessed by all the Cephalopods, and derived from the agency of the funnel, the decapodous genera are provided with lateral or terminal fins, more or less coriaceous, according as the habits of the animal are more or less pelagic or littoral. The motive function of the fins, however, appears to be secondary; those organs being used chiefly to sustain or steady the animal, and direct its course through the water. The position of the fins is used as a generic character.

The dibranchiate Cephalopods carry on their heads eight or ten arms, the place of

* In M. de Blainville's "Mémoire sur l'Animal de la Spirula et sur l'Usage du Siphon des Coquilles Polythalamées," the siphuncle is described as a solid tendinous prolongation of the retractor muscles, by means of which the animal is enabled to withdraw the cephalic mass within a cavity formed by the anterior extremity of the mantle, and thus to regulate the specific gravity of the body. It appears, however, from Professor Owen's examination of two specimens of *S. Peronii* (*fragilis*), captured and brought home by Captain Sir Edward Belcher (see Zoology of the Voyage of the Samarang), that the soft or membranous siphon is in reality a tube continued from the calcareous siphon and the last chamber of the shell, through a semicircular aperture in the mantle, into the visceral cavity.

† M. d'Orbigny, after referring to these means of escape in the Sepiæ, says (Moll. Viv. et Foss., vol. i, p. 134), that he is far from believing that the faculty is enjoyed by every species; and that, in fact, if it exists among the Sepidæ, it is at the least doubtful among the other Cephalopods, who possess but a small quantity of the liquid, which they only expel when dying.

which, in the tetrabranchiate Cephalopod, is supplied by a multitude of tentacula grouped around the mouth. These arms or tentacula are organs as well of locomotion as of touch and prehension. In the dibranchiate Cephalopod the arms are furnished with suckers (*acetabula*), and are of two kinds, viz. : eight *sessile* arms encircling the mouth, and connected at the bases by a muscular web more or less broad ; and two *tentacular* arms placed one on each side, and capable of considerable extension. The Octopods are furnished with the sessile arms only ; the Decapods possess also the tentacular arms. The development of the sessile arms appears to be in inverse ratio with the retro-swimming power of the animal, and, consequently, as we have before seen, with the size of the body. In the pelagic Decapods, which possess the highest retro-swimming power, and whose body is comparatively large, the arms are short ; while in the finless Octopods and the littoral Decapods, which have small bodies, and are consequently bad swimmers, and whose habits require the means of creeping along the ground, the arms are infinitely larger, and the connecting web is broader, so that they serve also for reptation.

The arms, to adapt them more perfectly for prehensile purposes, are provided with suckers placed *in serie*, on the inner surface. These are sometimes simple, i. e. *unarmed* ; but in some genera they are surrounded by a horny dentated hoop, and in others are *uncinated*, or armed with sharp, horny hooks. When the prey is once seized by this formidable apparatus, escape is hopeless. In the tetrabranchiate Cephalopod, which is always attached to a dense calcareous shell, and whose principal food appears to be the crustacea or testacea living at the bottom of the sea, the complicated mechanism of the arms entirely disappears, and the animal is provided with numerous, small, retractile tentacles, by which the sense of touch, as necessary to it as enlarged vision is to the dibranchiate Cephalopod, is largely developed.

The presence of the sucker bearing arms, or of the tentacula, is an ordinal distinction, and has been adopted by the French naturalists for the designation of the two orders, corresponding with the dibranchiate and tetrabranchiate orders of Professor Owen, into which they have divided the Cephalopods ; the armed and unarmed conditions of the suckers are also used as subordinal and generic distinctions, and characters of families and genera are founded upon the retractile power of the tentacular arms.

Exclusive of the impulsion derived from the funnel, and the capacity to rise and float in the sea which the chambered and siphoniferous shell affords, the tetrabranchiate Cephalopod can only creep, like the gasteropods, along the bottom of the sea by means of the free and expanded margin of the anterior extremity of the body.

The animal whose zoological peculiarities have been thus cursorily noticed, is sometimes lodged in a symmetrical shell, *unilocular* or *camerated* (multilocular), that is, presenting a series of chambers divided from each other by thin partitions (*septa*), and successively added by the animal to meet the exigencies of its increasing bulk, and in

the last of which the body is contained. The partitions present the greatest variety of form ; being in fact moulded upon the animal, they indicate corresponding zoological peculiarities, and generic distinctions have been founded upon them. Among the *Nautilidæ*, one of the families into which the tetrabranchiate Cephalopods are divided, the posterior extremity of the body is round and without any projecting part, or *lobe* as it is termed, and the septa therefore are characterised by simple curvatures or undulations, and their margins are always entire ; and thus we are led by analogy to believe, that in the *Clymenidæ* the animal had an angular lobe on each side of the body, from which the sinus, which characterizes their septa, would take its form ; and that in the *Ammonitidæ* the posterior extremity of the body had many lobes, the edges of which were foliated, whence the septa assumed corresponding curvatures with foliated margins. Sometimes, and this is most generally the case among the recent Cephalopods, the animal is without the protection of an external shell ; but it is then supplied either with a calcareous chambered shell almost wholly buried in the animal, or with a horny or calcareous substance, simple, or more or less complicated in form and structure, wholly internal, and encysted in the back of the mantle. From the presence or absence of the external shell, the Cephalopods have been, and in fact still are, popularly divided into shell-bearing and naked Cephalopods, although in the systematic arrangement proposed by Professor Owen these terms have a more restricted application.

The chambered shells are characterised by a peculiar apparatus, by means of which, as it has been generally supposed, they are made subservient to hydrostatic purposes, although the precise mode by which that end is attained is merely conjectural. From Professor Owen's description of the *Nautilus Pompilius*, it appears that the posterior part of the visceral sac is prolonged in the form of a membranous tube, which, passing through a short calcareous collar, formed in the disc of each septum, and called the *testaceous siphon*, traverses the different chambers to the extreme nucleus of the shell. This tube, with the calcareous collar which, more or less, covers and protects it, is termed the *siphon* or *siphuncle*, and is found in all the multilocular shells strictly so called, whether external or internal, recent or fossil ; and its position with reference to the margin of the shell, is used as another distinction between the *Ammonitidæ*, the *Clymenidæ*, and the *Nautilidæ* ; being ventral or external, that is, placed near the outer margin, in the *Ammonitidæ* ; central, that is, at or near the middle of the disc of the septum, in the *Nautilidæ* ; and dorsal, that is, close to the preceding volution, in the *Clymenidæ*.

The process by which the external shells of the Cephalopods are constructed does not appear to differ essentially from that used by the inferior molluscs. Professor Owen has described the mode of growth in the *Nautilus Pompilius* ; and we are led by analogy to the conclusion, that the shells of the extinct *Nautili* and the *Ammonites*, and their various cognate genera, were formed in the same way. In the recent

Nautilus the animal is attached to the shell by two large lateral muscles, called the *adherent* muscles, and by a belt or *cincture* of horny matter, which completely encircles the posterior part of the visceral sac, and expands at the sides into broad discs, which serve as the medium of insertion of the adherent muscles; and the prolonged posterior extremity of the visceral sac, forming the membranous siphuncle, is a third mode of attachment. As the animal increases in size, the adherent muscles and the cincture gradually advance their line of attachment, and the membranous tube at the same time lengthening in proportion, a cavity is thus formed between the septum and the lower portion of the visceral sac. A deposition of calcareous matter by the surface of the mantle then takes place, commencing at the sides of the shell, and proceeding towards the membranous tube, round which it is continued backward, and forms the *calcareous* or *testaceous* siphon. Thus, as the animal increases in bulk, the dwelling-chambers are successively formed and converted into air-chambers, by means of which the specific gravity of the shell and its contents is maintained nearly in equilibrio with that of the surrounding water. During the growth of the animal the anterior portion of the mantle secretes calcareous matter, which it deposits in successive layers on the margin of the aperture; and thus the enlargement of the outer wall of the shell is effected. I must add, that the theory of the gradual advance of the adherent muscles and the cincture during the growth of the animal is opposed to the opinion of M. d'Orbigny, who, in his hypothesis as to the function of the siphuncle, noticed subsequently, maintains in effect, that the advance of the muscles (and, I presume, of the cincture also) is periodic.

The Argonaut presents an extraordinary deviation from the general laws which govern all other molluscous animals; inasmuch as the animal, although perfectly free and unattached to the shell it inhabits, is not now considered to be a mere parasite,*

* It is foreign to the present purpose to enter into the question as to the parasitism of the *Ocythoe*; the experiments of Madame Jeannette Power, confirmed to a great extent by the observations of M. Sander Rang and M. d'Orbigny, and more recently by those of Mr. Adams, during the voyage of H.M.S. Samarang, are generally considered as removing all doubt as to that animal being the fabricator of the shell in which it is found; and the theory of parasitism is now rejected by nearly all naturalists. A detailed account of the facts ascertained and recorded by Madame Power and M. Rang will be found in M. Rang's *Mémoire*, published in Guérin's 'Magasin de Zoologie,' and in Madame Power's 'Observations on the Poulpe of the Argonaut,' translations of which are published in the 'Mag. Nat. Hist.,' new series, vols. iii and iv. The observations of Mr. Adams, published in the 'Zoology of the Voyage of the Samarang,' tend to prove that the shell is constructed by the female Argonaut as a nest for receiving her eggs, and protecting them from injury, resembling in some measure the rudimental capsules secreted by many marine Gastropods for the preservation of the embryo. The animal firmly retains possession of this light calcareous shell-nest by means of the broad expanded membranes of the posterior pair of tentacles; but when disturbed or captured, she loosens her hold, and leaving her cradle to its fate, swims about independent of her shell. Having once deserted the nest, it appears that she has not the power, or more properly the sagacity, to re-enter it. Numbers of male Argonauts were taken by Mr. Adams, but always without shells. There are, however, in this theory, difficulties which probably future observation may explain. In the first place, the shells

as at first was supposed to be the case, but the actual fabricator of the shell ; and it is believed that the broad membranes usually termed *vela* or *velamenta*, into which the extremities of the posterior pair of arms are expanded, and which usually envelope the shell, are the organs by which the deposition is effected ; the mantle itself, apparently, not being capable of a calcifying secretion.

The beaks or *mandibles* with which the mouths of the Cephalopods are armed, vary in structure according to the habits of the animal. In the dibranchiate Cephalopod, whose principal food consists of fish, the mandibles are sharp, and entirely composed of horn ; but, with the tetrabranchiate Cephalopods, the mandibles are blunt, and cased at their extremities with hard calcareous matter, adapted for the crushing of shells, and the defensive coverings of crustacea. The fossil substances called *Rhyncholites*, resembling the mandibles of the recent *Nautilus*, and found associated with the numerous chambered shells so abundant in the secondary and transition formations, appear to be remains of Ammonites, and the other cognate extinct genera by which those shells were inhabited.*

That the external chambered shells of the Cephalopods act in the same way as the swimming bladders of fish, and serve as floats, is obvious from the circumstance that, when deserted by the animal, they swim on the surface of the water. To an animal seeking protection against its enemies, by an instantaneous sinking in the sea, this tendency of the shell to float would prove a serious and dangerous impediment, if the animal itself did not possess the means, in some way or other, of increasing on the instant its specific gravity ; and it has long been the opinion of naturalists that the siphuncle is subservient to this purpose, although a difference of opinion has prevailed as to the mode of operation. Dr. Hooke, so far back as the beginning of the last century, expressed an opinion that the *Nautilus* had the power of generating air to fill the deserted chambers, and that by the injection or exhaustion of this air through the siphuncle, the specific gravity of the shell could be diminished or increased. It is ascertained, however, that there is not any communication between the siphuncle and the empty chambers ; and Mr. Parkinson, who, in his 'Outlines of Oryctology,' adopts an hypothesis similar to Dr. Hooke's, suggests that the tube is elastic and dilated by gaseous or aqueous fluids, the alternation of which produces a corresponding change in the specific gravity of the shell. Dr. Buckland

are found in different stages of growth, and they always exhibit the usual indications of successive periodic enlargements. Again, Mr. Adams states, "that it does not appear that the female is able to exist long when disengaged from the shell." How can these facts be reconciled with the theory that the shell is a mere *nidus* ?

* MM. de Blainville and d'Orbigny have founded on these remains two genera, which they have named *Conchorhynchus* and *Rhynchoteuthis*. The reasons advanced for supposing that the *Rhyncholites* were not the mandibles of any of the Nautilidæ or Ammonitidæ already known, are far from conclusive ; and these genera can only be regarded as arbitrary, though perhaps convenient, divisions, according to the peculiar forms presented by the remains.

maintains that a fluid is contained in the *pericardium*, the position of which is alternately changed from that cavity to the siphuncle; and that in this shifting fluid the hydraulic balance consists, the chambers being filled with air alone, the elasticity of which would admit of the alternate expansion and contraction of the membranous siphuncle. Prof. Owen has pointed out objections to both these hypotheses. The only organ apparently by which the gaseous fluids of Mr. Parkinson's theory can be secreted, is a small artery continued down the siphon, but which would not be adequate for the purpose; and the form and size of the siphon would not allow of an escape of gas so free as to make the consequent sinking of the shell sufficiently rapid for defensive purposes. In some extinct species of *Nautilus* the membranous siphuncle appears to have been capable of considerable dilatation, instances of which are mentioned by Dr. Buckland; but Professor Owen states that, in all the specimens he had examined, the membranous siphuncle, after the first chamber, presented an inextensible and almost friable texture, and was coated beyond the extremity of the testaceous siphon with a thin calcareous deposit; and that, in certain extinct species, the testaceous or calcareous siphon extended from septum to septum, rendering a dilatation of the membranous tube physically impossible. The calcareous siphon of the recent *Spirula*, as is well known, exhibits this form of structure. It is ascertained that, by the conversion of the dwelling-chambers of the animal into what may be termed air-chambers, the specific gravity of the *Nautilus*, and of its shell, may be maintained nearly in equilibrio with that of the sea. This equilibrium would be very sensibly affected by the position of the body of the animal with reference to the shell; and Professor Owen therefore inclines to the opinion* that the variation of the specific gravity is caused chiefly by changes in the extent of the surface exposed to the water, according as the body may be expanded beyond the aperture of the shell, or more or less withdrawn within the dwelling-chamber. At the same time it is not improbable that the siphuncle, filled with the fluid propelled into it from the pericardium, in consequence of the pressure caused by the contraction of the animal within the shell, may assist in affecting the specific gravity; it certainly, however, does not appear to be capable of varying the specific gravity of the shell sufficiently for the wants of the animal, and that function, if attributable to it, must consequently be merely secondary. I am therefore inclined to agree with M. d'Orbigny, who rejects the supposition that the action of the siphuncle is hydrostatic. That naturalist assigns to the membranous tube which enters the calcareous siphon, and communicates with the pericardial cavity, a function widely different, and only to be called into action when the animal constructs a new air-chamber. "On this occasion," he says, "many difficulties have to be overcome; the extremity of the body is attached above the last

* In this opinion M. de Blainville concurs (*Mémoire sur l'Animal de la Spirula*, &c.), and he shows that a similar mode is used by the *Spirula*; the alteration of the specific gravity being effected by the withdrawal of the cephalic mass into a cavity formed by the upper portion of the body.

septum (*en dessus de la dernière cloison*) by two powerful muscles; and the animal, always increasing in bulk, must detach its body, and remove and place itself at a determinate distance whenever it wishes to form a new partition. There must also be left, between the penultimate partition and that which the animal is about to construct, a space to be filled with air, while the animal is always under water." And M. d'Orbigny therefore suggests "that the membranous tube and pericardial cavity are required, when the new chamber is constructed, to empty the water contained in it, and to fill it with air before the siphon entirely closes its wall in the interior of the new air-chamber." This hypothesis does not appear to be more satisfactory than the one involving a hydrostatic function. No allusion is made in any way to the attachment of the animal to the shell by means of the *horny* or *epithelial cincture* which, as we have seen, encircles the lower part of the body. This cincture, in fact, hermetically closes the space between it and the last septum; and, unless it is detached, there would not be any external entrance through which the water could penetrate, and the function, the object of the hypothesis, becomes unnecessary. I cannot think therefore that this important attachment was overlooked; and I assume that M. d'Orbigny, when he says that the animal "must detach its body," means that it must detach not only the adherent muscles which he mentions, but also the horny cincture, to which he does not allude. Conceding this to be the case, then, the hypothesis in question assumes that the advance of the body, preparatory to the formation of the new partition, is not gradual; but that the animal, by sudden and nearly simultaneous efforts, detaches the adherent muscles and the cincture, and removes its body to the necessary distance. In all other testaceous molluscs, the advance of the adductor and adherent muscles is caused by the deposition of new matter, by means of a thin membrane, part of the pallial membrane, interposed between the extremity of the muscle and the inner surface of the shell. The deposition is made, particle by particle, on the anterior part of the muscle, portions of the posterior part probably becoming detached and absorbed; but this process is so gradual, that the attachment of the animal to the shell—an attachment, in fact, necessary to its existence—is not affected; and thus the muscle advances slowly and imperceptibly. There does not appear to be any reason for supposing that a law prevails among the cephalopodous molluscs different from that which regulates the advance of the adherent muscle in the testaceous gasteropod. We may readily conceive, on the contrary, that the entire detachment of the muscles and of the cincture would be attended with considerable inconvenience to the animal; for, in that condition, the fulcrum or resisting power by which the animal is enabled to use its tentacles and other organs efficiently, and which is essential to its existence, would be temporarily lost. The sudden removal of the body forward would probably, although it cannot be assumed that it would necessarily, cause the rupture of the membranous siphon, for that organ may be sufficiently elastic to stretch to the required

distance ; but the rupture is, in fact, required by the hypothesis, and the animal would thus be deprived at once of all its means of attachment to the shell. Neither by this periodic advance would the equilibrium of the specific gravity be maintained. We are warranted, I think, in assuming that the specific gravity of the animal and its shell, without the siphuncular aid, would be most nearly in equilibrio with that of the surrounding sea immediately after the formation of a new septum. Now the growth of the animal would constantly tend to derange this equilibrium, until the period should arrive for the formation of the new septum. The capability of the animal, therefore, to rise and sink would be as constantly fluctuating, unless there existed some mode of compensating for the increasing bulk of the body during the interval between the formation of the penultimate septum and that of the last. This compensation, however, would be provided in the case of a gradual advance of the line of attachment ; for the vacated part of the dwelling-chamber, filled with exhalations from the animal, and increasing in size as the body is advanced, would become an air-chamber as effective as if it were inclosed by a new septum ; while, on the other hand, a periodic advance of the muscles and cincture would deprive the animal of this mode of maintaining the equilibrium.

I have mentioned the rupture of the membranous tube, which would be the consequence of the sudden advance of the body ; in fact, the hypothesis which attributes to this tube the function of carrying off the water admitted into the vacated part of the shell by the detachment of the cincture, requires, *ex necessitate*, that the tube should be ruptured in order that the water should enter it ; and in that case the membranous siphon in the deserted chambers would consist of detached fragments extending from septum to septum, and which, having fulfilled their object and become severed from the animal, would no longer retain vitality. This, however, is not the fact. The membranous tube is continued entire through all the septa to the extreme air-chamber,* and is a vascular organized substance, provided with an artery and a vein for its nutrition ; and it maintains its vitality during the life of the animal. We are compelled, therefore, to think that the function of the siphuncle must be coextensive with the animal's existence. On these grounds, the theory suggested by M. d'Orbigny is not more satisfactory than the hydrostatic theory which he rejects. Whatever the function may be, it is evident that the air-chambers themselves would be as efficient a float without the siphon as with it ; and the alteration of the specific gravity, as has been stated, may and in all probability is, effected simply by the animal protruding or withdrawing the cephalic mass from or into the dwelling-chamber of the shell, or, as

* Professor Owen, speaking of the specimen of *Spirula Peronii* (*fragilis*), brought home by Sir Edward Belcher, says : "On gently raising the exposed portion of the siphon with a needle, the soft siphon was withdrawn, without sensible resistance, from the tube of the hard siphon ; the siphon so withdrawn must have reached nearly to the innermost whorl. It exhibited a slight segmentation, answering to the successively sheathed parts of the calcareous siphon."

M. de Blainville has shown to be the case in *Spirula*, within a cavity formed by the anterior extremity of the mantle. We may reasonably infer, therefore, that to assist in varying the specific gravity is not the principal function of the siphuncle. But, in any view, the preservation of the deserted chambers, as air-chambers, is essential to the motive power of the animal; for it is only by their tendency to float when the cephalic mass is protruded, that the animal is enabled to rise; and this nicely-adjusted counterpoise is maintained, as we have seen, by the addition of new air-chambers, as the animal and the shell increase in size. It is obvious, therefore, that the hydrostatic balance would be destroyed if any one of the deserted chambers were so injured as no longer to act as a float. Now it is known that the shells of the testaceous molluscs are not wholly inorganic substances; but that a vital communication is maintained between them and the animals, and that where this communication ceases, the deserted whorls of the shell lose their vitality and become brittle; the calcareous matter falls off in particles, and the shell is much more susceptible of injury. In *Bulimus decollatus* (*Helix decollata*, Linn.) and other similar shells, in which the earlier whorls are wholly deserted, the animal on withdrawing its body forms behind its extremity a concave septum. In these cases the apex of the shell, no longer necessary, is easily broken off; in which state the shell is said to be *decollated*.^{*} In the siphoniferous shells, however, the preservation of the chambers, as air-chambers, is, as we have already seen, essential to the motive power of the animal. It is true that in the *Nautilus*, the mode of convolution, upon a vertical axis, is admirably adapted to strengthen and protect the first-formed volutions; but in shells not so constructed, and even in those possessing the nautiliform mode of convolution, it would appear to be essential that the vitality should not be lost. How, then, is the necessary communication between the animal and the air-chambers maintained, and the vitality of the deserted shell preserved? It has been shown that the siphuncle traverses the chambers to the extreme nucleus of the shell, and that it is provided with a small artery and vein; and we also learn from Professor Owen's Memoir, that in the *Nautilus* "a delicate pellicle, distinct from the tube, is continued over the outer part of the testaceous tube, and also over the whole inner surface of the chamber." May we not then reasonably regard the siphuncle with its artery and vein, and the pellicle lining the air-chambers, as the organs destined to maintain the vitality of the shell, and feel ourselves justified in considering this office to be in fact the primary function of the siphuncle? And when we bear in mind that the internal shells, from

* I am wholly indebted to my friend Mr. Searles Wood for the following theory as to the siphuncular function, and the main arguments in support of it. The well-known conchological attainments of that gentleman exact respect for every opinion of his on subjects like the present; but independently of this, the theory itself seems to me to be far more probable than any hitherto advanced as to the office of the siphon; and I therefore gladly avail myself of Mr. Wood's permission to introduce his views of the subject into my text.

their terminal or, as in *Spirula*, their exposed position, are particularly liable to injury from the shocks caused by the retrogressive movements of the animals, we shall find that the hypothesis will be as applicable to them as to the external shells. In the extended series of observations made by Dr. Carpenter upon the microscopic structure of shells, it is shown by that gentleman that the outer covering or shelly mass of molluscous animals is invariably permeated by an organized membrane, and he says (Report Brit. Assoc., 1844, page 9): "I am much disposed to believe that in every distinct formation of shell substance there is a single layer of membrane, and I am further of opinion that this membrane was at one time a constituent part of the mantle of the mollusc." He further represents this membrane to have, more or less, a cellular arrangement, the interstices of which are filled with carbonate of lime or inorganic matter; and, at page 10, he says: "Coupling the appearances which I have myself observed, with the observations of Mr. Bowerbank, on the formation of shell, and keeping in view the general doctrines of cell action which I have elsewhere endeavoured to develope, I am inclined to believe that these cells are the real agents in the production of the shell, it being their office to secrete into their own cavities the carbonate of lime supplied by the fluids of the animal." He does not appear to have extended his researches so far as to determine whether any or what amount of vitality is possessed by these membranes; but from the continuity and intimate connexion of this beautiful network, permeating the entire substance of the shell, we may imagine that some slight degree of vital existence pervades the whole membrane, by which it is possible that the inorganic material is preserved from disintegration. In those shells which appear to have been subject to the erosive action of acidulated waters, or other external agency, such as the apices of *Cerithia* and the umbones of *Cyrenæ*, the part most affected is that which is furthest removed from the main body of the animal; while that part of the shell which is in close proximity with the mantle is not, or at least but little, altered; probably owing to its greater vitality, and to its being the part most essential for the protection of the animal. Not only is the entire formation of shelly matter permeated by an organic membrane, but in some of the shelly coverings of molluscous animals in the order *Brachiopoda*, there is a very peculiar structure, somewhat analogous with what has been before suggested as the especial use of the siphuncular tube in the Cephalopoda. Dr. Carpenter has pointed out that in most, or perhaps in all, of the nonplicated species of *Terebratula*, the whole surface of the shell is perforated with innumerable pores, into which are inserted vascular portions of the mantle of the animal, of a tubular form, and filled with fluid, which have no communication with the exterior, but are closed at the outer surface of the shell, and occupy the entire space of the pores. These caecal appendages may be for the purpose of distributing a greater degree of vitality through the body of the shell; though for what especial purpose this provision is required in one group more than another, it is not easy to explain; perhaps a greater degree of strength is

required in the *nonplicated* shell, for the preservation of an animal, whose habitation, for the most part, is at a considerable depth, where the pressure of water is much increased, than in the plicated species, the peculiar construction of which would afford sufficient resistance, without that additional support which the smoother species may receive from this singular structure of the mantle. If, however, a necessity exist for the preservation of the shell in ordinary cases, how much more essential would it be that some compensating power should be possessed by an animal whose existence, in all probability, is dependent upon the buoyant principle of its partitioned shell; and how probable does it appear that this, an ordinary provision, should be employed for its protection.

The tubular character of the siphuncle suggests an hydraulic action. To explain this, it is necessary to invest the animal with the power of emptying and filling the tube at discretion; and this power it may be presumed to derive from the pressure upon the pericardial cavity, caused by the folding and contracting within the shell of the large cephalic mass. Under this pressure the fluid would be injected the whole length of the siphuncle, and, on the removal of the pressure, would return into the pericardium, to be there renovated and vivified with the other fluids, to be again injected when the animal returns within the shell. If the siphuncle had been a solid body, or composed of muscles, fibres, &c., it would have required to be permeated with arteries, blood-vessels, &c., for its sustenance; but by the simple process of the fluid returning into the body of the animal, all the complicated apparatus necessary to sustain a fleshy body is superseded; circulation and renovation are accomplished, and the fluid is thus maintained in a condition capable of affording the nourishment to the shell which the present hypothesis requires.

The theories here suggested are, as all other theories on the same subject must for the present be, merely speculative; for, to quote the observation of Professor Owen,* “much remains to be done before the theory of the chambers and siphuncle can rest on the sound basis of experiment and observation.” These alone will satisfactorily determine the real purposes of the membranous siphuncle; but, for my own part, I believe that the primary, and probably the only, function of that organ is to maintain the vitality of the shell, and that it may be looked upon as an elongated cæcum; and that it is not, under any circumstances, used by the animal as a hydrostatic balance.

It is unnecessary here to particularise the various forms of external shells presented by the extinct tetrabranchiate Cephalopods, inasmuch as, of the numerous genera which swarmed in the ancient seas, only the *Nautilus* survived the secondary period.

The dibranchiate Cephalopods, with the exception of the genus *Argonauta* (which, with *Bellerophon*, constitutes Professor Owen’s family of testaceous Octopods), are without

* Memoir on the *Nautilus Pompilius*, p. 47.

external shells ; but they are provided with internal horny or calcareous substances, encysted in the back of the mantle, and frequently not in any way attached to the animal, but loose in the cells containing them. In the naked Octopods these internal substances are of the simplest form, and consist of two short, horny, gelatinous styles. Among the Decapods, they become gradually more complicated in structure. In the *Loligidae*, the *Loligopsidae*, and the *Teuthidae*, they assume the form of a horny plate, termed the *gladius*, which in some genera is thin and feather-shaped, or more or less spatulate, lanceolate, or ensiform ; and in others, they are elongated, narrow, and terminated posteriorly by a simple cup-shaped appendage. In the *Sepidae* the shell presents a series of thin calcareous plates, not siphoniferous, but separated by numerous exceedingly minute pillars, and forming a convex mass terminated by a *muco* or spine ; in the *Belemnitidae* it consists of a chambered cone perforated by a siphuncle, and lodged in a cavity formed in the upper portion of a calcareous rostrum, more or less pointed or obtuse ; and in the *Spirulidae*, the sole remaining family, it is a calcareous, horizontally convolute, multilocular, and siphonated shell, with distinct whorls, and imbedded in the animal, but having portions of the last whorl merely covered by the outer layers of the skin. These differences in structure appear to be always accompanied with distinct zoological forms ; and hence the Palæontologist is enabled to form a tolerably correct judgment of the analogy between the existing species and those which inhabited the ancient seas, although the testaceous remains are, most frequently, the only means of comparison afforded to him.

These internal shells are formed by secretions, from the internal surfaces of the cells, of a horny or calcareous substance, which is deposited in successive layers, and by the continual addition of which they increase in size as the growth of the animal proceeds. Their functions are various, and in accordance with their particular structure. When the internal shell is gelatinous or horny, as in the Octopoda, and in the *Loligidae*, *Loligopsidae*, and *Teuthidae*, the function is chiefly to support and strengthen the body, analogous with that of the bones in the vertebrate animals. It appears that the greater or less length of the shell has always relation to the swimming power of the animal. When the internal shell is horny or calcareous, and contains parts filled with air, as is the case in the several other decapodous families, it acts as a float ; and in this function, like the external shell of the tetrabranchiate Cephalopods, it represents the swimming bladder of fish ; but the volume of air contained within the shell is, apparently, in an inverse ratio with the swimming power of the animal. In addition to these functions, the internal shells, which are provided with a *muco* or rostrum at their posterior extremities, as in the *Sepidae* and *Belemnitidae*, are enabled by its means to break the force of the shocks caused by the body striking against any hard substance in its retrograde motion. In the recent Cephalopods this protection is confined to the *Sepidae*, the most littoral of all the Cephalopods : to the deep-sea swimmers it is denied : it would in fact be

useless to them. We may assume, therefore, that in the extinct Cephalopods the presence of the mucro or rostrum will indicate a littoral animal. M. d'Orbigny states that he has always observed in the *Sepia*, the extremity of the mucro projecting beyond the body, and it is not improbable that this part of the shell may be used, as he suggests, for defensive purposes, and that it is protruded at the will of the animal.

The Cephalopods, highly organized as they are in comparison with the other molluscs, are among the earliest forms of animal life which geology has brought to light. The Silurian group, the most ancient fossiliferous formations with which we are acquainted, contains the remains of one species of *Nautilus*, and of many species belonging to cognate genera. Several species of *Goniatites*, an anomalous genus belonging to the *Ammonitidæ*, and connecting that family with the *Nautilidæ*, also occur. As we ascend in the Palæozoic series, we find that various of the primitive genera and species disappear, and are succeeded by other forms, distinct from, although closely allied to, them; which, in their turn, are also lost. On passing into the Mesozoic series a marked change takes place. Of the eight genera constituting the family *Nautilidæ*, which lived during the Palæozoic epoch, *Orthoceras** and *Nautilus* alone survive; and of the long series of species belonging to the latter genus, whose remains are found in the carboniferous formations, every one disappears; but an immense array of *Ammonites* starts into existence, with septa at first comparatively simple, but becoming more complicated in structure in the succeeding formations. The dibranchiate Cephalopods now first appear.† In the Oolitic group, twenty-five species of *Belemnite*, and remains of various genera belonging to the families *Loligidæ* and *Teuthidæ*, have been found. The *Belemnites* occur in incredible quantities, and sometimes form entire strata. Passing into the Cretaceous group, we still find the *Nautilus*, though of diminished importance: the *Ammonites* are reduced in number to little more than a fourth part of the species found in the Oolitic group, and new modes of convolution appear in their shells, on which the several other genera constituting the family *Ammonitidæ* are founded. The family itself gradually diminishes as we ascend in the Cretaceous group, and wholly disappears with the secondary period. The *Belemnites* appear to be the sole representatives of the dibranchiate Cephalopods during this epoch, and with it they also perish. On entering into the tertiary formations we find, that of the rich and varied assemblage of tetrabranchiate Cephalopods which characterised the fauna of the secondary period, only the *Nautili* survived. On the Continent their remains are found in the Eocene formations, and also in the Miocene formations, at Turin and in Touraine; but in this country they are confined to the older Eocene deposits. Of

* Von Hauer (*Nene Cephalopoden aus dem rothen Marmor von Aussee*), describes several *Orthoceratites* associated with *Goniatites* in the schistose beds of St. Cassian; those beds, I believe, are now generally considered to belong to the *Muschelkalk*.

† The remains described by Goldfuss and Bronn as *Spirulæ*, appear to belong to *Gyroceras*, a genus of the *Nautilidæ*.

the dibranchiate Cephalopods, two species of Argonaut have been found in the newer tertiary formations on the Continent; and two genera belonging to the family *Belemnitide* occur in the beds of the Paris basin, and in the Eocene formations of England. The remains of one of these last are very closely allied to the recent *Sepia*, and have been generally referred to that genus. M. Voltz, in his 'Observations sur les Bélemnites,' pointed out certain differences which induced him to propose a new genus, named by him "*Belosepia*," for their reception. The French Palæontologists reject this genus as having been proposed on insufficient grounds; but, for the reasons stated in a subsequent part, it ought, as it appears to me, to be retained. The other remains found in the Paris basin, connect *Belosepia* with *Belemnite*; and the genus *Beloptera* has been established by M. Deshayes for their reception. Both these genera occur in the London clay and in the Bracklesham sands; and they, together with certain remains found in the neighbourhood of London, and described by Mr. James Sowerby in the Mineral Conchology as *Beloptera anomala*, and for the reception of which I have proposed the new genus *Belemnosis*, are the only remains of dibranchiate Cephalopods which as yet have been found in the tertiary formations of England.

That these animals fulfilled in the ancient seas the office of repressing animal life cannot be doubted. The living Cephalopods are voracious in the extreme; and, as we find that throughout the transition and secondary groups the number of the zoophagous Trachelipods is small in comparison with that of the phytophagous Mollusca, it is not unreasonable to seek in the Cephalopods for that check upon an excessive increase of submarine life, which the other zoophagous molluscs were too inconsiderable in number to afford.*

There is scarcely any class in the animal kingdom of the anatomy and habits of which zoologists have so long remained ignorant, or of which the systematic arrangements proposed have been so conflicting as the class Cephalopoda. Composed, as it is, of animals in their external construction and appearance remote from all others, and widely differing among themselves, we need not feel surprised at the confusion which characterises the older systems, based, as they all were, more or less, on artificial characters, derived from the various conditions of the shell, or from modifications of the dermal system; and the confusion was increased by the introduction among the Cephalopods of numerous microscopic chambered shells, to which M. d'Orbigny gave the name *Foraminifera*, but which the recent investigations of Dujardin show to have been constructed by an inferior class of animals, belonging or allied to the Zoophyta, and which he has named *Rhizopoda*. It would be foreign to the purpose to enter here into any history or comparison of the different systems of arrangement which have been proposed. In the eleventh volume of Lamarck's 'Histoire Naturelle des animaux sans vertèbres,' edited by MM. Deshayes and Milne Edwards the reader

* See Dr. Buckland's Bridgewater Treatise, vol. i, chap. xv.

will find a most comprehensive and able review of the progress of this branch of natural history.

The principle of classification adopted by Cuvier removed many of the difficulties and inconsistencies which had previously prevailed; but it was still based, to a great extent, on external characters. Attempts at arrangements, founded on higher characters, were made by different authors; but the imperfect knowledge which existed of the anatomy of the animals, prevented the establishment of a system in which due regard could be paid to affinities indicated by internal organization. Of late years, however, considerable additions have been made to our knowledge of the anatomy of these animals; and in 1830, the arrival in this country of a specimen of the pearly Nautilus, caught off the coast of one of the New Hebrides, enabled Professor Owen to examine the internal structure of that animal, an opportunity which had not occurred to naturalists since the time of Rumphius. The anatomy of various other Cephalopods was also investigated by Professor Owen; and the additional information thus obtained, led that gentleman, in 1836, to propose a system of classification which, although at variance in many respects with all previous arrangements, was at once received as one founded, in its general principles, on well-defined and natural characters; and this system, accordingly, forms the basis of the more recent classifications.*

All the Cephalopods the anatomy of which had been examined previously to the arrival of the pearly Nautilus, respired by the agency of two branchiæ or gills, and possessed three hearts, a systemic heart, and two lateral hearts; they were also endowed with eight arms furnished with suckers, some genera having also two elongated tentacula or additional arms. The pearly Nautilus, however, was found to be possessed of four branchiæ, and of only one heart; and, instead of arms, the mouth of the animal was surrounded by numerous short tentacula. Availing himself of these natural and well-defined characters, Professor Owen divided the Cephalopoda into two orders: 1st, *Dibranchiata*, comprising those furnished with two gills; and 2d, *Tetrabranchiata*, comprising those furnished with four gills. The *Dibranchiata* were subdivided into two sub-orders or tribes, according to the number and condition of their locomotive organs; the first tribe (*Octopoda*) consisting of the Cephalopods with eight arms, having the suckers simple, and the branchial chamber divided by a diaphragm; the second tribe (*Decapoda*) consisting of those Cephalopods possessed

* Up to this time *Spirula*, as well as *Belemnites*, had been classed with *Nautilus*, and the other Cephalopods which now form the tetrabranchiate order (*Ceph. test. polythalamaces* of Lam.; *Siphoniferes* of D'Orb.) Of the anatomy of the animal nothing was known; but the presence of an ink-bag, and the acetabuliferous character of the arms had been shown by Lamarck and Peron; and from this fact Professor Owen, aided by that knowledge of the laws of correlation which imparts such value to all his observations, inferred that the animal must present the dibranchiate type of structure. The accuracy of this deduction is now fully established.

of eight arms, and two additional elongated tentacula. In this tribe the suckers are armed, and the mantle supports two lateral or terminal fins. The "*Octopoda*" were divided into two families, termed "*Nuda*" and "*Testacea*," according to the absence or presence of an external shell. In the second family was placed *Bellerophon*, an extinct genus proposed by De Montfort for remains peculiar to the Palæozoic series, which Defrance had associated with Argonaut, but which subsequently had been considered as belonging to a heteropodous mollusc. The reasons which induced Professor Owen to restore *Bellerophon* to a place among the Cephalopods are not stated. If however, its remains belong to this class, they present the anomaly of the testaceous Octopods having been without a representative from the end of the carboniferous epoch until the deposit of the newer tertiary formations, when the family reappears in the genus Argonaut. The decapodous Cephalopods were divided into four families, according to the position of the fins, the nature of the internal shell, and the condition of the infundibular cartilage. The ordinal and sub-ordinal distinctions of Professor Owen have been adopted by M. Deshayes, but that naturalist has subdivided the Octopoda and Decapoda each into two groups; the Octopoda according to their possessing one or two rows of suckers, and the Decapoda according to the position of the fins. These characters appear to be of secondary importance, and, by themselves, can scarcely be considered as sufficient for more than generic distinctions. M. d'Orbigny has availed himself of the presence of suckers and tentacles, characters originally proposed by himself and M. Ferussac as ordinal distinctions, and accordingly the Cephalopoda are divided by him into *Acetabulifera* and *Tentaculifera*. The sub-ordinal distinctions of Professor Owen are adopted by this author; but in his subdivision of Octopoda he has drawn his characters from the presence or absence of the apparatus for resistance, and the aquiferous pores. The Decapoda are arranged by him in two groups, according to the modification in the structure of their eyes, to which I have before alluded. The first group (*Myopsidæ*) is divided into three families. In two of these, *Sepidæ* and *Loligidæ*, the characters are taken from the retractile power of the tentacular arms, the condition of the internal shell, and the presence or absence of an eyelid of a part of the auditory apparatus called by him the auricular crests (*crêtes auriculaires*), and of a superior ligament to the funnel; the character of the third family (*Spirulidæ*) rests entirely on the internal shell. The second group (*Oigopsidæ*) also consists of three families, two of which, *Loligopsidæ* and *Tenthidæ*, depend on the presence or absence of a lachrymal sinus and the auricular crests, on the funnel being or not being provided with an internal valve and ligaments, on the condition of the aquiferous pores, and on the shell being with or without air-chambers. The *Bolemitidæ*, the third family, is separated entirely by the character of the internal shell.

The peculiar modifications in the structure of the eyes among the decapodous Cephalopods appear to be of sufficient importance to justify the subdivision of that sub-order into the two groups proposed by M. d'Orbigny; and inasmuch as the adoption

of that division involves the distribution of the genera forming Professor Owen's extensive family *Tenthidæ* between the two groups, and the characters on which M. d'Orbigny has formed his families are at the least of equal importance with those used by Professor Owen, I have adopted the classification proposed by M. d'Orbigny, but with the following modification. That author has placed *Beloptera* and *Spirulirostra* among the *Spirulidæ*. Now the shells of these genera present a series of siphonated air-chambers associated with a rostrum, and therefore bear a much closer affinity with *Belemnite* than with the shell of the recent *Spirula*. I have, therefore, placed them, as well as *Belemnosis*, among the *Belemnitidæ*; and as I agree with Voltz in considering *Belosepia* to have possessed a camerated and siphoniferous shell, I have also placed that genus in the same family, notwithstanding the close affinity between its remains and the internal shell of the recent *Sepia*.

CLASSIFICATION OF THE CEPHALOPODS.

CEPHALOPODA.

MOLLUSCA

Dibranchiata
(Acetabulifera; *Fer. et d' Orb.*)

Octopoda . .

Octopidæ { Eledone.
Octopus.
Pinnoctopus.
Cirroteuthis.
Philonexidæ { Philonexis.
Argonauta.

Decapoda . .

Myopsidæ . . { Sepidæ . . . { Cranchia.
Sepiola.
Sepioloidea.
Rossia.
Sepia.
Spirulidæ . . | Spirula.
Lolidæ . . { Loligo.
Sepioteuthis.
Teudopsis.
Leptoteuthis.
Beloteuthis.
Oigopsidæ . . { Loligopsis.
Chiroteuthis.
Histioteuthis.
Teuthidæ . . { Onychoteuthis.
Enoploteuthis.
Kelano (*Acanthoteuthis*, *Wagn.*)
Ommastrephia.
Belemnosepia *Agaz.* (*Geoteuthis*, *Muns.*)
Belemnitidæ . { Belosepia.
Beloptera.
Belemnosis.
Spirulirostra.
Conoteuthis.
Belemnoteuthis.
Belemnitella.
Belemnites.

Tetrabranchiata.
(Siphonifera; *Fer. et d' Orb.*
Tentaculifera; *d' Orb.*)

Nautilidæ { Nautilus.
Planulites (*Lam.*)
Gyroceras.
Lituus.
Campulites, *Desh.* (*Cyrtoceras*, *Goldf.*)
Phragmoceras.
Orthoceras.
Actinoceras.
Koleoceras (*Portl.*)
Poterioceras *M'Coy* (*Gomphoceras*, *Sow.*)
Clymenidæ { Aturia.
Clymenia.
Ammonitidæ { Turritiles.
Helicoceras.
Goniatites.
Ammonites.
Crioceras.
Scaphites.
Ancyloceras.
Hamites.
Toxoceras.
Ptychoceras.
Baculites.

ORDER—*DIBRANCHIATA*. SUB-ORDER—*DECAPODA*.Tribe—*OIGOPSIDÆ*.1st Family—*BELEMNITIDÆ*.

The *Belemnitidæ*, the sixth family in the classification proposed by M. d'Orbigny, consist, according to that author, of the genera in which the animal was provided with an internal horny or calcareous shell, having at the *posterior part* air-chambers superimposed in a nearly straight line in the form of a cone, and pierced on the ventral part by a marginal syphon. The family is confined, according to that author, to the three extinct genera, *Conoteuthis*, *Belemnitella*, and *Belemnites*.

The two latter genera, however, do not appear to fall strictly within the terms of the definition: for the posterior parts of their shells consist, as is well known, of a spathose guard, frequently of considerable size, the anterior extremity of which is produced so as to form an alveolus for the reception of the phragmocone. If, as the fact is, the genus *Belemnites* forms the typical genus of the *Belemnitidæ*, it would surely be proper that those genera which, like the type, possess camerated siphoniferous shells, terminated posteriorly by a calcareous guard, should, at all events, be included in the family. It is difficult therefore to conceive on what sound principle *Spirulirostra* and *Beloptera*, but more particularly the last genus, whose calcareous remains present so striking a resemblance to those of *Belemnites*, instead of being placed in this family, have been associated with *Spirula*, with whose spiral discoidal shell they present so little analogy.

It appears to be desirable that, for the present at least, the *Belemnitidæ* should be extended so as to comprise all the genera in which the animal possessed an internal horny or calcareous shell, with or without a terminal guard, but containing air-chambers pierced by a ventral siphuncle: whether those chambers were superimposed in a nearly straight line in the form of a cone, or in a spiral or subspiral line. As thus enlarged, the *Belemnitidæ* will consist of the following genera: *Belosepia*, *Beloptera*, *Belemnosis*, *Spirulirostra*, *Conoteuthis*, *Belemnoteuthis*, *Belemnitella*, and *Belemnites*.

Hereafter it may be desirable to form a division for the reception of genera in which, as in *Conoteuthis*, the apex of the sheath is simple.

All attempts at a linear arrangement are absolutely futile; but it will be seen that in this, as in every case where several genera are grouped together, the family presents aberrant forms leading to other groups; thus *Beloptera*, *Belemnosis*, and *Belosepia*, leading to *Sepidæ*; *Belosepia* and *Spirulirostra* to *Spirulidæ*; and *Conoteuthis* to *Teuthidæ*.

Genus 1st. **BEOLOSEPIA.*** *Voltz.* 1830.

SEPIA. *Cuvier ; Férussac ; d'Orbigny ; Deshayes.*

BEOLOSEPIA. *Bronn.*

Animal unknown ; but, from the affinities between its calcareous remains and the internal shell of the recent Sepia, supposed to have more nearly resembled that genus than any other existing Cephalopod, and may be thus described :

Body oblong, (?) naked, supporting two lateral fins extending its whole length ; *mouth* terminal, furnished with two corneous mandibles, and surrounded by ten prehensile acetabuliferous arms, of which two were longer than the others ; *mantle* free at the anterior margin ; *branchiæ* two.

Shell internal, oblong, semiconical, coarsely granulated or sulcated on the exterior, internally smooth, containing a series of transverse laminæ, perforated near their ventral margins by large elliptical, sub-siphoniform openings, and terminating in a solid beak or rostrum, inflected towards the dorsal aspect, and expanded at the anterior extremity on the dorsal aspect into an elevated callus, and on the ventral aspect into a semi-circular plate bent outwards over the base of the rostrum ; the ventral margins of the laminæ converging towards the anterior extremity of the rostrum, and connected by a thin calcareous plate.

Testâ internâ, oblongâ, semiconicâ, externè granulatâ, internè lævigatâ ; septa transversa, foraminibus ventralibus ellipticis subsiphonoidis perforata, continenti, et rostro solido, anticè, parte dorsali in callum proeminentem, parte ventrali in laminam supra rostrum reflexam dilatato, posticè sursum inflexo, terminatâ ; septorum marginibus ventralibus ad basim rostri convergentibus et tenui laminâ connexis.

The remains of this extinct Cephalopod have been long known as of frequent occurrence in the Paris basin ; they were noticed by Guettard† and were described by him as the fossil teeth of sharks. They were also figured by Burtin,‡ and by him were considered to be internal bones of a fish's head. To Cuvier palæontology is indebted for pointing out their true character. In a short notice published in 1824, in the 'Annales des Sciences Naturelles,' that illustrious naturalist referred the remains in question to a cephalopodous mollusc closely allied to the recent Sepia ; and, in fact, they, as well as the remains of another extinct Cephalopod which exhibited an unquestionably camerated and siphoniferous structure, and for the reception of which the genus *Beloptera* had been established by M. Deshayes, were placed by M. d'Orbigny in that genus. M. de Blainville also in the first instance described them as the remains of a Sepia ; but afterwards, when he adopted the genus *Beloptera* for the *Sepia*

* Etym. Βελος, telum ; Σηπία, sepia.

† Mémoires sur différentes parties des Sciences et Arts, 1783, Septième Mémoire, pl. 2, figs. 29-30.

‡ Oryctyographie de Bruxelles (1784), pl. 2, fig. A.

Parisiensis, he confounded with it the remains in question. M. Voltz was the first to examine these remains with the attention they deserve. This author instituted a comparison between the shell of the *Beloptera Belemnitoidea*, that of the *Beloptera Sepioidea* (*Sepia Parisiensis*), and the recent *Sepion*, and stated the reasons which induced him to consider the *Beloptera Sepioidea* as belonging to a distinct genus, equally removed from the *Beloptera Belemnitoidea* and the recent *Sepia*, and as forming a natural connexion between *Belemnites* and *Sepia*; and he proposed the present genus, *Belosepia*, for its reception. The principal ground advanced by him to justify this separation was, that the remains of *Belosepia* indicated a camerated and siphoniferous structure in the contents of the sheath, widely different from that of the *Sepion*; and, if this opinion be correct, there cannot be a doubt as to the propriety of the separation. M. Deshayes, however, in his 'Description des Coquilles fossiles des Environs de Paris,' without questioning in any respect the accuracy of M. Voltz's description, without referring even to that author's opinion as to the siphoniferous structure of the shell, but simply relying on the analogy drawn from the general resemblance between the remains of the *Sepia Parisiensis* and the *Sepion*, unhesitatingly rejected the genus *Belosepia* as not possessing characters sufficiently distinct from those of *Sepia*; although he considered that it would be desirable to form a section in the genus *Sepia* for the reception of the fossil species. In this opinion M. Deshayes has been followed by MM. Pictet and d'Orbigny. I cannot concur with these authors in the rejection of M. Voltz's genus. The *Belosepion** appears to me to present peculiarities of structure, indicating corresponding important zoological differences, which render it impossible to regard the animal to which it belonged as forming part of the existing genus *Sepia*.

The *Belosepion*, like the internal shell of the *Sepia*, is a compound shell, and consists of—1st, a solid calcareous mucro, or rostrum, commonly called *the beak*, inflected at the posterior extremity towards the dorsal aspect, and at the base expanding on the dorsal aspect into an elevated, compressed, and more or less rugose mass, called by M. Deshayes the *callus*, and on the ventral aspect into a thick semi-circular plate, bent outwards, in a radiated fold, over, but not touching, the upper portion of the rostrum, denticulated on the margin, and continued laterally into the parietes of the sheath.

2d. An inverted semiconical calcareous plate, termed the *sheath*, externally coarsely granulated, internally smooth, but presenting a series of undulating impressions, converging towards the inverted apex, where the sheath terminates in a conical cavity, formed in the anterior portion of the rostrum, and strongly inflected towards the ventral aspect, so that the posterior extremity presses against the origin of the radiated fold.

* The term *Belosepion* is used here to describe the entire internal shell of the *Belosepia*; in the same way as the term *Sepion* (*Sepiostaire* of De Blainville) is used by English writers to describe the internal shell of the *Sepia*, or what is usually known as "Cuttlefish-bone."

3d. A thin calcareous layer, covering the whole of the inner surface and the terminal cavity of the sheath; and

4th. A series of thin laminæ or septa imposed one upon another, at first nearly vertically, but assuming gradually a horizontal direction, owing to the convergence, towards the origin of the radiated fold, of their ventral margins, which are nearly straight, and connected by a calcareous plate, forming the ventral surface of the sheath.

The undulating impressions which appear within the sheath are strongly defined on the dorsal aspect, but become faint as they approach the ventral surface. M. Voltz has described these undulations as impressions of the sutures of the *alveolus*;^{*} while, on the other hand, M. d'Orbigny considers them to be lines of growth, and not marks of the chambers, which, he says, in fact only occupied one half of the cavity. They are, however, strictly analogous with the similar impressions found in the *Sepion*, and are formed by the margins of the laminæ or septa. Being formed in succession as the new laminæ are added, it is true that in that way they represent the progressive increase of the shell; but they are not true lines of growth.

The extreme fragility of the laminæ has not allowed of their preservation; but their remains occur, not unfrequently, towards the posterior extremity of the sheath, consisting of fine elevated lines, which traverse the whole circumference of the cavity, and are, in fact, the dorsal and lateral margins of the laminæ adhering to the inner sheath. These lines are continued over the calcareous plate, which connects the ventral margins of the laminæ; and it is evident, therefore, that the laminæ extended across the whole of the transverse area of the sheath.

The ventral margins are always convergent towards the origin of the radiated fold; and, consequently, the laminæ within the terminal cavity slant in a direction opposite to that of the laminæ within the sheath, inasmuch as that the cavity extends wholly below the origin of the fold. Owing to this, the arrangement of the chambers formed by the septa somewhat resembles that of the air-chambers in *Spirulirostra*, except that in the latter shell the plane of the septa is always at right angles with the axis; while in the *Belosepion* it is at an angle more or less acute as the septa approach to, or recede from, the point of convergence. In the cavity itself, the dorsal margins of the laminæ are distant; but as they approach that part of the sheath which is immediately under the point of convergence, they are placed more closely to each other, and they again become distant as the laminæ emerge from the cavity. Owing to the convergence of their ventral margins, the laminæ, which as they emerge are nearly vertical, take a direction gradually more and more slanting towards the anterior extremity of the rostrum, until, on the shell attaining its full growth, they assume a position nearly

* The word *alveolus* is used by this author in its original meaning, and is applied to the chambered cone which Professor Owen has named the *phragmocone*. The term *alveolus* has been with greater propriety restricted by the latter gentleman to the cavity in which the *phragmocone* was lodged.

horizontal. This arrangement of the laminae is well displayed in fig. 1½, Tab. I, drawn from a specimen found at Sheppy, for the use of which I am indebted to Mr. Dixon, to whom it belongs. The ventral margins of the laminae extend quite across the connecting plate before mentioned; and on each side, at a short distance from the extremities, they expand into the lateral portions of the laminae, small projecting fragments of which are sometimes still found adhering to the sides of the sheath. It is evident from this that the opinion expressed by M. Voltz, that there existed in each of the laminae an opening placed near the ventral margin, is correct. These openings appear to have been of an elliptical form, with their shorter axes in a line from the ventral to the dorsal surface, and were lined with an extremely thin calcareous sheath, which extended throughout the whole series of the laminae, and of which portions are frequently found adhering to the inner edges of the ventral margins and the lateral fragments of the laminae. This sheath corresponds with the siphon of the Belemnites, and is represented in the Sepion by the calcareous layer which, extending over the posterior edges of the laminae, covers the entire surface of the last lamina, and it presents, as M. Voltz states, an intermediate form between the narrow, straight siphon of the Belemnites and the wide, open cavity of the Sepion.

Whether the spaces between the laminae were filled with minute columnar partitions, similar to those which characterise the Sepion, or whether they were simple air-chambers, we have not at present any evidence to determine. The probability is, that they were simply air-chambers; for no trace whatever of any substance similar to that termed the spongioid tissue of the Sepion has been found, which, had any such substance existed, might reasonably have been expected; and the true siphonal structure, to which the Belosepion presents so close an approximation, is always associated with simple air-chambers. The Belosepion, as its rostrum indicates, belonged to a Cephalopod eminently littoral in its habits, and the size, notwithstanding the extraordinary development of the rostrum, leads us to believe that the animal was not only smaller, but a less powerful swimmer, than the recent Sepia. We should expect, therefore, to find in it some provision for buoyancy beyond that with which the recent Sepia is furnished, not only for the purpose of increasing the swimming power of the animal, but also as a compensation for the large and dense rostrum and callus which characterise its remains. But if the interlaminal spaces were filled with any substance resembling the spongioid tissue of the Sepion, the floating apparatus of the Belosepion would be apparently inadequate to the wants of the animal. The form and mode of superposition of the laminae, somewhat resembling the arrangement of the septa in *Spirulirostra*, present a closer analogy with the phragmocone of the Belemnites than with the plates of the Sepion. These considerations give additional weight to the opinion of M. Voltz, founded on the appearance of what he terms the "alveolar sutures," that the Belosepion was a camerated and siphoniferous shell.

The rostrum of the Belosepion presents a structure analogous with that of the

spathose guard of the Belemnite. It has a tendency to split in two along the centre, in a vertical plane, from the ventral to the dorsal aspect; and it is composed of successive conical layers, each enveloping the preceding layer, and exhibiting a fibrous texture crosswise. The anterior lateral and dorsal portions present straight plates, longitudinally fibrous, resembling the structure of the *Beloptera Belemnitoidea*, and the external edges hang over each other, and give an imbricated appearance to that part of the rostrum.

In order to appreciate the differences which appear to render it desirable that the genus *Belosepia* should be retained, it may be well to give a short description of the internal shell of the recent *Sepia officinalis*. This will be found to consist of five distinct parts: 1st, an outer layer of calcareous matter, called the *buckler* or sheath, convex, rugose externally, and prolonged at the posterior extremity into a calcareous spine, placed in the medial line, and inflected towards the ventral aspect; 2d, a series of horny layers imposed one over another, extending over the posterior dorsal surface of the buckler, and wholly enveloping and extending beyond the spine; 3d, a thin horny layer spread over the whole of the internal surface, and extending beyond the edges of the buckler, and which, in its turn, is entirely covered by, 4th, a calcareous layer, which contains the spongoid tissue and, 5th, a series of convex horny laminae, impregnated with carbonate of lime, placed horizontally, the posterior edge of each succeeding lamina being a little withdrawn from that of the preceding lamina, so that by this mode of superposition they present a depression or cavity immediately above the origin of the spine, and gradually rise into a convex mass at the middle and upper extremity of the shell. The spaces between the laminae act as air-chambers, but there is not any siphuncle or siphonal opening; and the surfaces of the laminae are studded with an infinite number of minute columnar and sinuous partitions, placed at right angles to the laminae, and giving them support.

It will be seen from this that the *Belosepia*, although bearing a close general resemblance to the *Sepion*, still presents several strongly-defined differences. The elevated calcareous mass or callus, which, in the *Belosepia*, terminates the sheath on the dorsal aspect, attaining frequently a considerable size, is not found in the *Sepion*: and the fold, which in the latter is represented by a series of horny layers, distinct from, but wholly enveloping, the spine, is, in the former, a thick calcareous plate, formed by the expansion and retroflexion of the anterior extremity of the rostrum, and extending barely beyond the line of the callus. In the *Sepion* the rostrum is small, in some species little more than rudimentary, and inflected, if at all, towards the ventral aspect. In the *Belosepia*, on the contrary, it attains a very large size, and, as M. Pictet observes, would indicate a gigantic animal if it were in relation to the animal in the same proportion as the *Sepion*; and it is invariably inflected towards the dorsal aspect. The internal laminae of the *Sepion* are horizontal, equidistant, and parallel, and so arranged as to form a hollow at the posterior ventral portion of the sheath, but rising

into an elevated mass towards the middle ; while in *Belosepion*, after emerging from the terminal cavity, in which they radiate, as it were, from the origin of the fold, they are at first nearly vertical, with the edges of the ventral margins ranged in a line with the ventral surface of the rostrum, and converging towards the inverted apex of the sheath ; so that, as the sheath enlarges, the dorsal edges of the laminæ become more and more distant, and the laminæ themselves tend gradually towards a horizontal position ; and in fact, in an adult individual, the last laminæ become nearly horizontal.

Owing to the different mode of arrangement of the laminæ, the *Sepion* and *Belosepion* differ materially in their shape and general aspect. In each the dorsal plate or sheath is extended so as to embrace the laminæ ; but in the *Sepion*, the laminæ of which are horizontal, and placed in a direction nearly parallel with the sheath, it is necessarily much less convex and more extended than in the *Belosepion*, in which the laminæ, being vertical, or more or less vertically inclined, present to it merely their dorsal and lateral margins. The buckler of the *Sepion*, and its contents, are, therefore, in form an elongated oval, depressed in the direction from the ventral to the dorsal aspect, and but slightly convex on the surfaces ; while in the *Belosepion* the sheath is considerably shorter, enlarging gradually towards the anterior extremity, and presents a deep semiconical cavity, containing within it the whole area of the laminæ, and it is obliquely truncated at the anterior extremity, and flat on the ventral surface, which does not extend to half the length of the shell. The most important difference, however, is, that the laminæ of the *Belosepion* possess large ventral, siphonal, or siphoniform openings, a structure which is not found nor represented in the *Sepion*.

These distinctions indicate corresponding zoological peculiarities ; and the animal, although, perhaps, resembling *Sepia* more closely than any other recent Cephalopod, must yet have presented such marked differences from it as to render it impossible satisfactorily to refer its remains to that genus, and fully to justify the separation proposed by M. Voltz. I have, therefore, retained that author's genus, *Belosepia*, notwithstanding the array of authorities against it ; and I have the less hesitation in doing this, when I find that Cuvier did not refer the remains in question to *Sepia*, but to some Cephalopod closely allied to that genus ; and that M. de Blainville, when he adopted the genus *Beloptera*, did not hesitate to remove them from the genus *Sepia*, to which he had referred them, although he placed them, under some misapprehension, in the genus *Beloptera*.

With respect to the place of *Belosepia* in the systematic arrangement, as the shell presents a camerated and siphoniform structure and a terminal guard, and is therefore more nearly related to Belemnite than the recent *Sepia*, I have removed it from the family *Sepidae*, in which M. d'Orbigny has placed it, to the family Belemnitidæ. It seems to have prepared the way for the recent *Sepia*, and leads from that genus, by a natural and easy transition through *Beloptera* and *Belemnosis*, into *Belemnitella* and *Belemnite*.

The specific characters are taken from the rostrum, the callus, and the fold. These parts, however, are of secondary importance only, and would vary in form considerably, not only with the age, but probably with the sex of the animal. Distinctions founded upon them, therefore, must necessarily be somewhat vague and uncertain; and, in fact, M. Deshayes, from not attaching sufficient importance to changes resulting from age or other circumstances, has proposed three distinct species, viz. *Belosepia longispina*, *B. longirostris*, and *B. Blainvillii*, on remains which, as well as those of the *B. Cuvieri* (of Deshayes), M. d'Orbigny considers to be varieties of the same species attributable to age.

Four well-defined species are known at present, viz. 1st, *B. sepioidea* (De Blainv.), consisting of *S. longispina*, *S. longirostris*, and *S. Blainvillii* (Desh.); 2d, *B. compressa* (De Blainv.); 3d, *B. Cuvieri* (Desh.), which I consider to be the *B. Owenii* of Sowerby; and 4th, *B. brevispina* (Sowerby). With the exception of the *B. compressa*, which has not yet been found in England, they all occur in the eocene strata of this country. The first three species are found in the Paris basin, and the *B. Cuvieri* has also been found in the tertiary deposits of Belgium.

No. 1. *BELOSEPIA SEPIOIDEA*. *De Blainv.* Tab. I, fig. 1 *a—i*.

BELOPTERA SEPIOIDEA; *De Blainv.* 1825. Mal. add. et correct. p. 621, tab. 11, fig. 7.

SEPIA CUVIERI; *D'Orb.* 1825. Tab. Méth. de la Classe Ceph. p. 67.

BELOPTERA SEPIOIDEA; *De Blainv.* 1827. Mém. sur les Bélem. p. 110, tab. 1, fig. 2, *2a, 2b*.

— — *Sowerby.* 1829. Min. Con. vol. vi, p. 183, tab. 591, fig. 1.

BELOSEPIA CUVIERI; *Voltz.* 1830. Obs. sur les Bélem. p. 22, tab. 2, fig. *6a—g*.

SEPIA CUVIERI; *Galeotti.* 1837. Mém. sur la Constit. Géogn. de la Prov. de Brabant, p. 140.

— *LONGISPINA*; *Desh.* 1837. Foss. des Env. de Paris, p. 757, tab. 101, fig. 4-6.

— *LONGIROSTRIS*; " " p. 758, tab. 101, fig. 10-12.

— *BLAINVILLII*; " " " " fig. 13-15.

— *CUVIERI*; *Bronn.* 1837. Lethæa Geognostica, p. 1127, tab. 42, fig. 19 *a—c*.

BELOPTERA LONGIROSTRUM; *Morris.* 1843. Cat. of Brit. Foss. p. 178.

SEPIA LONGIROSTRIS; *Pictet.* 1845. Traité élém. de Paléont. vol. ii, p. 315.

— *LONGISPINA*; " " " "

— *BLAINVILLII*; " " " "

— *SEPIOIDEA*; *D'Orb.* 1845-7. Moll. viv. et fos. vol. i, p. 269.

BELOSEPIA CUVIERI; *J. D. C. Sowerby.* 1849. Dixon's Geol. Hist. of Bracklesham, Selsey, and Bognor, &c., p. 109, tab. 9, fig. 11*a*.

— *LONGIROSTRIS*; " " p. 109, tab. 9, fig. 15.

— *LONGISPINA*; " " p. 109, tab. 9, fig. 12.

— *BLAINVILLII*; " " p. 109, tab. 9, figs. 16, 17.

Non *SEPIA CUVIERI*; *Desh.* Foss. des Env. de Paris, p. 758, tab. 101, figs. 7-9.

B. rostro elongato, crasso, acuto, recto aut plus minusve arcuato; laminâ ventrali crassâ, profundè radiatim sulcatâ, in margine posteriori denticulatâ; callo dorsali profundè et irregulariter rugoso, deorsum producto aut erecto.

This species presents considerable variations in the form, as well of the callus as of the rostrum ; and, in fact, M. Deshayes has separated it into the three species *B. longispina*, *B. longirostris*, and *B. Blainvillii*, chiefly on account of the different conditions of the rostrum. M. d'Orbigny, attributing the variableness of the rostrum to the age of the animal, or to alterations caused by fossilization, to which I would also add changes resulting from attrition, has united these species under the specific name *B. sepioidea*, originally given by De Blainville. Possessing a long series of specimens, comprising individuals in different stages of growth, and in which the peculiarities of form, taken by M. Deshayes as specific characters, appear to pass gradually into each other, I have no doubt as to the propriety of the union, proposed by M. d'Orbigny, of the three species above mentioned. That author, however, has added to them a fourth species, proposed by M. Deshayes, *B. Cuvieri* ; but which, as it exhibits constant and well-defined differences, I think should be retained.

The *rostrum* of *B. sepioidea* is elongated, and pointed at its posterior extremity ; on the inferior or ventral surface it is sometimes, particularly when young, nearly straight, but more frequently it is bent, at about half the length, in an angle more or less obtuse, towards the dorsal aspect ; the dorsal surface presents a sharp cutting edge, slightly arched, and, at its juncture with the callus, exhibits a depression, which is strongly marked in mature specimens. At the base, immediately beneath the callus, it is more or less dilated, and it is angulated at the margins ; the ventral surface is more or less convex. The *callus* is narrow, compressed, and deeply rugose ; the posterior margin forms an acute angle with the axis of the rostrum, varying considerably in different specimens. In some instances the inclination of the posterior margin is at an angle more or less obtuse with the axis of the rostrum ; a condition which, as it appears to me, is attributable to the fracture and attrition of the extremity of the callus, as the specimens in which this form occurs present a smooth worn appearance. The *ventral plate*, immediately beneath the rostrum, is nearly horizontal, but presents a broad undulation, corresponding with the convexity of the ventral surface of the rostrum ; the lateral extremities, as they approach the sheath, gradually diminish in breadth, and assume a nearly vertical position. In consequence of this variation in breadth, the ventral plate, which, at the superior margin, is nearly semi-circular, presents a regular semielliptical form on the posterior margin. It exhibits on the ventral surface a series of sulci, radiating from the apex of the terminal cavity, and varying in depth ; and it is deeply and sharply denticulated on the posterior margin. As the shell enlarges, the plate is thickened considerably by successive layers added to the ventral surface. The last layers frequently do not envelope, but are a little withdrawn from the margin of, the preceding layers, leaving the previous denticulations partly uncovered ; and consequently the margin of the ventral plate, in an adult specimen, often presents a double row of denticulations.

The lateral portions of the sheath exhibit deep vascular impressions at the posterior extremity.

The *B. sepioidea* is found plentifully at Bracklesham Bay, on the coast of Sussex; it is also found at Stubbington (near Gosport) and at Sheppy. In France it occurs, according to M. d'Orbigny, in the lower calcaire grossier at Chaumont (en bas), Vivray, and Saint Germain; in the upper calcaire grossier at Chaumont (en haut), Grignon, Courtagnon, Parnes, Muchi-le-Châtel, &c., and, in the sandy beds above the calcaires grossiers, at Tancrou, Aumont, Acy, &c.

The specimen (Pl. 1, fig. 1*h*) exhibits nearly the entire form of the shell; it was found at Sheppy, and enriches the cabinet of Mr. Dixon. The length is four inches, and the breadth across the superior extremity of the sheath, if the cast were perfect, would be rather more than an inch. The remains commonly found seldom consist of more than the rostrum, with, occasionally, portions of the ventral plate, and, more rarely, of the posterior extremity of the sheath. The ordinary size of the rostrum is six tenths of an inch* long, and three tenths wide at the superior extremity.

No. 2. *BELOSEPIA CUVIERI*. *Deshayes*. Tab. I, fig. 3 *a—e*.

SEPIA CUVIERI; *Desh.* 1837. Foss. des Env. de Paris, p. 758, tab. 101, fig. 7-9.

— — *Nyst.* 1843. Descr. des Coq. et des Polyp. des Terr. tert. de la Belg. p. 610, tab. 46, fig. 1.

— — *Pictet.* 1845. Traité élém. de Paléont. vol. ii, p. 315.

— *SEPIOIDEA* (sp.); *D'Orb.* 1845-7. Moll. viv. et fos. vol. i, p. 269.

BELOSEPIA OWENI; *J. D. C. Sowerby.* 1849. Dixon's Geol. Hist. &c. p. 109, tab. 9, fig. 13*a*.

Nec *SEPIA CUVIERI*; *D'Orb.* 1825. Tab. Méth. de la Classe Ceph. p. 67.

Nec *BELOSEPIA CUVIERI*; *Voltz.* 1830. Obs. sur les Bélemn. p. 22, tab. 2, fig. 6*a-g*.

Nec *SEPIA CUVIERI*; *Sow.* Min. Con. vol. vi, p. 183, tab. 591, fig. 1.

Nec *BELOSEPIA CUVIERI*; *J. D. C. Sow.* 1849. Dixon's Geol. Hist. &c. p. 109, tab. 9, fig. 11*a*.

B. Testá extremitate posticali lateraliter dilatátá; rostro brevi, crasso, arcuato, acuto, ad basim latissimo; laminá ventrali arcuatá, profundè sulcatá, in margine denticulatá; callo dorsali profundè rugoso, margine inferiori recto aut sursum vergenti.

M. Deshayes, in his description of this species, refers to *Beloptera sepioidea* (*Beloptère* de Cuvier) of De Blainville, and to the specimen figured by Mr. Sowerby in 'Mineral Conchology,' as identical with it. The description given by M. de Blainville is rather sub-generic than specific, and is too general for the purpose of identity; but the figures given by him are evidently those of a mutilated specimen of

* In stating the size of the shells I have used tenth parts of an inch, in order to facilitate a comparison with the measurements of French shells; as tenths of an inch may be readily, and with sufficient accuracy, converted into "millimetres" by taking 1 tenth as equal to $2\frac{1}{2}$ millim. The exact proportion is 305 millim. = 12 inches; i. e. 1 in. = 2.54166 &c. millim.

B. sepioidea, and do not correspond with the specific description given by M. Deshayes. Through the kindness of Mr. Sowerby I have had an opportunity of examining the specimen from which his figure was taken, and it is unquestionably a *B. sepioidea*; the peculiar form of the rostrum being caused by the fracture of the posterior extremity, and the abrasion of the lower part of the outer layers. The present species is well defined by M. Deshayes; and as I have a series of specimens in different stages of growth in which the distinctions are preserved, I do not hesitate to retain it.

The *rostrum* is short, thick, slightly arched, and very broad at the superior extremity; on the dorsal surface, at the posterior extremity, it is compressed, and presents a cutting edge for about one half of the length; the superior extremity is marked by a broad depression extending to the callus. The *ventral plate* is less elliptical, and the denticulations less prominent, than in *B. sepioidea*. The *callus* is nearly perpendicular to the axis of the rostrum, and enlarges rapidly, owing to the greater width of the terminal cavity.

The specimen figured in Mr. Dixon's work, under the name *B. Owenii*, appears to belong to this species. Mr. Sowerby was probably induced, by the synonyms quoted by M. Deshayes, to consider the *Sepia Cuvieri* of that author as identical with the *Beloptère de Cuvier* of De Blainville; and as the specimen before him could not be referred to that species, he proposed the species *B. Owenii* for its reception. The specific name *Cuvieri*, however, having been improperly used by MM. d'Orbigny and Voltz for the *B. sepioidea* of De Blainville, must now be retained for the present species, to which it was applied by M. Deshayes, and it will consequently supersede the name *Owenii* proposed by Mr. Sowerby. M. Nyst cites for his specimens M. Deshayes's description of *B. Cuvieri*, and has, in fact, copied the figures given by that author. I have therefore considered them as identical.

Hitherto, I believe, *B. Cuvieri* has been found, in England, only at Bracklesham Bay, where it is not by any means common. The French localities quoted by M. Deshayes are Grignon, Courtagnon, Parnes (upper cal. gross.). M. Nyst gives the sandy beds at Boitsfort, Assche, Jette, Forêt, Uccle, and Ghent, as the Belgian localities.

The length of the rostrum is .3 inch, and its breadth at the superior extremity .3 inch.

NO. 3. BELOSEPIA BREVISPIA. *Sowerby*. Tab. 1, fig. 2 a—c.

BELOSEPIA BREVISPIA; *J. D. C. Sowerby*. 1849. *Dixon's Geol. Hist.*, &c., p. 109, tab. 9, fig. 14.

B. rostro per-brevi, crasso, acuto, in aspectum ventralem valde convexo et regulariter arcuato; laminâ ventrali profundè sulcatâ, vix denticulatâ; callo dorsali in margine inferiori compresso, sursum vergenti.

A species much resembling the young of *B. Cuvieri*; but, according to the few specimens we possess at present, it is distinguishable by the shortness and the greater convexity of the inferior surface of the rostrum, and also by the dorsal surface, which is rounder than in *B. Cuvieri*, slants downwards, and, even in the largest specimens, barely presents the cutting edge which distinguishes the two preceding species. The *callus* is longer in proportion, and is so much compressed, as to present a narrow, almost a sharp edge; and it enlarges more rapidly than even in the last species, owing to the greater width of the terminal cavity.

The *ventral plate* is semicircular, and nearly smooth on the inferior margin, and, owing to the width of the cavity, is transversely elliptical on the superior margin; it is also narrower and more deeply sulcated than in *B. Cuvieri*.

The *B. brevispina* is found at Bracklesham Bay, and is very rare. I possess four specimens of different sizes, which all present the same characteristic form; but it is not improbable that a larger series would show that the species is but the young form, or at all events only a variety, of *B. Cuvieri*.

The length of the rostrum is .2 inch; the width rather less than .2 inch.

Genus 2d. BELOPTERA. *Deshayes*.*

Animal unknown, but supposed to have been closely allied to the Belemnite, which, as described by Professor Owen, appears to have been oblong; the head, surrounded by ten arms, (?)† furnished, like those of the recent genus *Ongychoteuthis*, with a double alternate series of slender, elongated, horny hooks; mandibles horny; (?) the body purse-shaped, conical, elongated, supporting near the middle two lateral fins, rounded and entire along their free margin; inclosing an ink-bag.

Shell internal, composed of two cones placed apex to apex, united, and expanding on each side into wing-shaped appendages, obliquely inclined towards the ventral aspect; the anterior cone smooth, longitudinally fibrous, hollowed into a deep conical cavity, containing regular transverse concave septa, pierced by a ventral siphon.

B. Testá interná, duobus conis, apice ad apicem conjunctis, formatá; utroque latere duobus appendicibus aliformis, deorsum inclinatis, sustentá; superficie dorsali convexá, ventrali concavá; cono anteriori levigato, longitudinaliter fibroso, cavitati conicá, profunda, septa transversa continenti, excavato; septis concavis, regularibus, siphone ventrali perforatis.

Guettard, the first author by whom these remains appear to have been noticed,

* Etym. Βελος, telum; πτερον, ala.

† The eight sessile or normal arms only have as yet been found preserved. Professor Owen states that the traces of the superadded pair of tentacula are somewhat doubtful.

described them as the teeth of fish. Long subsequently, M. Deshayes examined similar remains found in the Paris basin; and, having observed in them characters which induced him to refer them to an extinct Cephalopod nearly allied to the Belemnites, he proposed the present genus for their reception. M. de Blainville, whose 'Manuel de la Malacologie' was then in course of publication, and to whom M. Deshayes had communicated his proposed genus, confounded with the remains in question those of the so-called fossil Sepiæ (Belosepiæ); but in adopting the genus *Beloptera*, he divided it into two sections, the first containing the fossil Sepiæ, which he characterised as species having wing-shaped appendages united at the superior extremity of the rostrum; the second section containing the true Beloptera, he described as species having the appendages distinct and the cavity conical, and with chambers and a siphuncle. The mistake is continued by M. de Blainville, in the Supplement to his 'Mémoire sur les Bélemnites,' published in 1827. In 1830, Voltz pointed out the differences which rendered it necessary to keep the two genera distinct; and, about the same time, M. Deshayes published, in the 'Encyclopédie Méthodique,' under the article *Béloptère*, the grounds which induced him to establish that genus. Notwithstanding this publication, however, the error into which M. de Blainville had fallen was repeated by MM. d'Orbigny and de Férussac, in their 'Histoire des Céphalopodes,' and by Cuvier, in his Memoir on the bones of the fossil Cuttle-fish, published in the 'Annales des Sciences Naturelles.'

Mr. Sowerby afterwards, when he adopted the genus provisionally for the curious and unique fossil obtained from Highgate, which he published in the 'Mineral Conchology' under the name *Beloptera anomala*, confined the genus to those species which contained a chambered cone like the Belemnites, and referred the species contained in M. de Blainville's first section to the genus *Sepia*. The absence, in the Highgate fossil, of the lateral wing-shaped expansions, and of the blunt terminal rostrum which characterise the two known species of *Beloptera*, as well as other characters to which I shall hereafter refer, seems to me to require the establishment of a distinct genus for the reception of those remains; and the genus *Beloptera* will be then confined to those species which possess lateral expansions, and which, as M. Deshayes himself describes them, exhibit an entire conical and chambered cavity, resembling that of the Belemnite, joined to a terminal rostrum, like that of the Belosepia.

As thus restricted, the *Beloptera* present, at the anterior extremity, a semiconical cavity, slightly depressed on the ventral aspect, in which was contained a thin calcareous layer, covering the entire inner surface. The inner cone formed by this layer contained a series of transverse, regular, and exceedingly thin septa, traces of which, consisting of their sutures or lines of junction with the inner sheath, are very distinct. These sutures, as they approach the ventral aspect, are slightly bent downwards towards the inverted apex of the cone, and present an acute sinus-like inflection

as they rise over a slight linear elevation, which traverses the whole length of the alveolus, along the medial line of the ventral inner surface, evidencing the presence and position of the siphuncle. The opening, or anterior extremity of the conical cavity, is slightly elliptical, having the shorter axis in the direction from the ventral to the dorsal aspect. The margin of the outer sheath is thin and sharp, and its ventral paries is much thicker than the dorsal paries, and rises into an elevated mass, depressed on the surface. The outer sheath itself is composed of a series of concentric layers, and exhibits a fibrous texture, like the sheath of the Belemnite. The apex is prolonged into a dense calcareous mass, strongly inflected towards the ventral aspect, and enlarged towards the posterior extremity, where it becomes attenuated, and is obliquely truncated. This mass is composed of longitudinal laminae, radiating from the apex of the cone, and so arranged, that the central laminae are in a plane extending from the ventral surface to the back, and the rest in planes gradually diverging more and more towards the back. The outer edges of the laminae are distinct and slightly elevated, giving a rough sulcated appearance to the surface. The cone and the calcareous mass into which it is prolonged expand laterally into two smooth semi-elliptical appendages, inclined obliquely towards the ventral aspect, thin and sharp on the outer edges, and gradually thickening as they approach their bases. These expansions consist of two distinct series of layers, deposited on the ventral and dorsal surfaces, and exhibit impressions which, as M. Deshayes remarks, are probably attributable to the presence of a vascular system in the substance of the mantle.

It will be seen from the foregoing description that *Beloptera* presents a much closer analogy with the Belemnites than that exhibited by *Belosepia*. The open semiconical cavity of the latter, in its typical form, nearly resembles the sheath of the Sepion; but the laminae, both in their mode of arrangement and in their large siphoniform openings, present the first indications towards the phragmocone of the Belemnite. In the aberrant form, *Belosepia compressa*, both the sheath and the laminae recede a step further from the Sepion type, and prepare the way for, and in fact connect *Belosepia* with, *Beloptera*. In this genus a still nearer approach to Belemnite appears; the wide, open, but shallow sheath of the Sepion, with its siphonless and nearly parallel laminae, is lost, and is replaced by an entire conical sheath, containing regular transverse septa perforated by a siphuncle, and exactly corresponding with the sheath and phragmocone of the Belemnite. The fold of the Belosepion, formed by the retroflexion and lateral enlargement of the ventral paries of the sheath, largely developed in the typical form, disappears in *Beloptera*, and is represented by the lateral expansions which characterise that genus, and which, greatly reduced in size in *Beloptera Levesquei*, lead directly into the simple sheath of the Belemnite; while the strongly inflected rostrum of the Belosepion assumes the form of a somewhat conical mass, and thus prepares the way for the elongated and regularly conical guard of Belemnite.

Exclusive of the *Beloptera anomala* (Sow.), for which I have proposed the genus *Belemnosis*, only two species of *Beloptera* are as yet known, i. e. *B. Belemnitoidea*, and *B. Levesquei*. Both species occur in the Paris basin, and in the Eocene beds of England. The first has also been found at Laeken in Belgium, and at Biaritz.

The specific characters are taken from the conditions of the lateral expansions and of the conical sheath.

No. 4. *BELOPTERA BELEMNITOIDEA. De Blainville. Tab. 2, fig. 1a—g.*

- TOOTH OF A FISH; (?) *Guettard*. 1783. Mém. sur les Glossopètres, tab. 2, figs. 10, 11, 12.
BELOPTERA BELEMNITOIDEA; De Blainv. 1825. Mal. add. et correct. p. 621, tab. 11, fig. 8.
SEPIA PARISIENSIS; Fér. et D'Orb. 1825. Tab. Méthod. des Céph., Ann. des Sc. Nat. vol. vii.
BELOPTERA BELEMNITOIDEA; De Blainv. 1827. Mém. sur les Bélemn. p. 111, tab. 1, figs. 3, 3a, 3b.
— — *J. D. C. Sowerby.* 1829. Min. Con. vol. vi, p. 183, tab. 591, fig. 3.
BELOPTERA BELEMNOIDEA; Voltz. 1830. Obs. sur les Bélemn. p. 20.
BELOPTERA BELEMNITOIDEA; Deshayes. 1830. Encyc. Méthod. vol. ii, p. 135.
— — *Keferstein.* 1834. Die Naturgeschichte der Erdkörper, &c. p. 430, No. 2.
— — *Deshayes.* 1837. Descrip. des Foss. des Env. de Paris, p. 761, tab. 100, figs. 4-6.
— — *Bronn.* 1837. Lethæa Geog. p. 1129, tab. 42, fig. 18a-b.
— — *Fér. et D'Orb.* 1839. Céph. Acetab. Seiches, tab. 3, figs. 7-9; tab. 24, figs. 11-12.
— — *Nyst.* 1843. Descr. des Coq. et des Polyp. foss. &c. p. 612, tab. 6, fig. 2.
— — *Pictet.* 1845. Traité élément. de Paléont. vol. ii, p. 316; tab. 14, fig. 2.
— — *Deshayes.* 1845-6. 2d Edit. de l'Histoire Nat. &c. p. 243.
— — *D'Orb.* 1845-7. Moll. viv. et foss. vol. i, p. 308, tab. 14, figs. 1-4.
— — *J. D. C. Sowerby.* 1849. Dixon's Geol. Hist. of Bracklesham, &c. p. 109, tab. 9, fig. 18.

B. testá ovato-elongatá, longitudinaliter recurvá; supra convexá; subtus concavá, depressá; cavitate anticá sub-cylindricá: rostro obtuso, striato: appendicibus lateralibus magnis, semicircularibus.

Shell oblong, compressed; the sheath straight and nearly elliptical; the ventral paries considerably thickened and depressed on the medial line below the siphuncle, so as to present an elevated sub-quadrate ridge, bifurcated at the posterior extremity. The rostrum enlarges gradually for about two thirds of the length, and then diminishes towards the extremity, which, in young specimens, is nearly conical in form, but in adult ones becomes very obtuse, probably from attrition; it is inflected towards the ventral aspect whence the shell presents longitudinally a somewhat arched appearance. The

lateral expansions are inclined towards the ventral aspect, and give a convex form to the dorsal surface, and a corresponding concavity to the ventral surface; they are thick at the juncture of the rostrum and sheath, and become gradually thinner as they enlarge, presenting a sharp cutting edge on their free outward margins. In this, the typical species, they are largely developed, regular in form, and vary considerably in size according to the age of the individual; in young specimens they present an elongated semielliptical form, which, as the shell advances towards maturity, becomes nearly semicircular.

Figs. 1*f* and 1*g* represent a variety in which the inferior cone is shorter, broader, and more compressed, and the wings are wider than in the ordinary specimens.

The *B. Belemnitoides* is found in England at Bracklesham Bay, where it is somewhat rare. In France it is found in the nummulitic bed at Biarritz, in the Lower Pyrenees; the lower beds of the calcaire grossier at Vivrais, Gypseuil, and Pouchon (Oise), and, in the middle beds, at Grignon, Parnes, Muchi-le-Châtel, Chaumont, &c. It also occurs in Belgium, in the sandy beds at Laeken.

The size is eleven lines in length, and four lines and a half in width across the widest part of the lateral expansions.

No. 5. **BELOPTERA LEVESQUEI.** *D'Orbigny.* Tab. 2, fig. 2*a*—*c*.

BELOPTERA LEVESQUEI; *D'Orb. et Fér.* 1839. Céphal. Acetab. Seiches, tab. 20, figs. 10-12.

— — *Pictet.* 1845. Traité élément. de Paléont. vol. ii, p. 316.

B. testá oblongo-elongatá, arcuatá, subtus carinatá, lateribus depressá, sub-excavatá; anticè cylindrico-angustatá: rostro obtuso, striato: appendicibus lateralibus parvis, linearibus.

Shell elongated, arched: the sheath straight and nearly cylindrical: the ventral paries thickened, and laterally much compressed, so that, instead of the flat square-shaped, bifurcating ridge which distinguishes the preceding species, it presents along the middle of the sheath, beneath the siphuncular line, a somewhat acute angular keel, which is continued on the upper part of the rostrum, and the sides of which are a little depressed. The rostrum itself is larger, and is transversely more compressed, and less inflected towards the ventral aspect, than that of *B. Belemnitoidea*.

M. d'Orbigny describes the species as destitute of lateral expansions; but, in the figures given by him, there are unquestionable indications of those appendages, very slightly developed it is true, yet still representing the wing-shaped expansions which characterise the genus. In one of the two English specimens, the only two with which I am acquainted, and for the use of which I am indebted to Mr. Wetherell, the lateral expansions are broken away, but their existence is evidenced by a deep suture on each side where they were inserted into the shell. The other specimen unfortunately is broken off just above the juncture of the sheath with the rostrum, at the precise part

at which the expansions would first appear ; but their presence is indicated by a slight curve in the outline caused by their origin. I do not hesitate, therefore, to attribute to this species the characteristic lateral enlargements, although they are very feebly developed.

M. Deshayes, in his 'Description des Coquilles fossiles des Environs de Paris,' mentions a specimen in his possession, too much mutilated for description, in which the rostrum is smoother and more elongated, and the wings appear to be much narrower than in *B. Belemnitoidea*, and not to be inclined downwards as in that species ; and for which, when better known, he thinks it will be necessary to form a new species. May not that specimen be referred to this species, which has been established since the publication of M. Deshayes's work ?

The English specimens of this species have hitherto been found only at Highgate, and are exceedingly rare. In France, according to M. d'Orbigny, the species occurs only in the lower strata of the Paris basin ; that is to say, in the sands below the nummulite bed, at Thury-sous-Clermont, Gillocourt, and Cuise-Lamotte (Oise).

The size is twelve lines long and three lines wide.

Genus 3d. **BELEMNOSIS.*** *F. E. Edwards.*

BELOPTERA ; J. D. C. Sowerby.

Animal unknown but supposed to be closely allied to the Belemnite.

Shell internal, oblong, semiconical, with the apex inflected towards the ventral aspect, and enlarged into an obtuse umbo, pierced by a pore on the ventral surface ; the anterior part hollowed into a deep semiconical cavity extending to the pore, and having the inner surface covered by two calcareous sheaths, one within the other, continued over the ventral surfaces of, and enveloping, a series of transverse septa, perforated by a ventral siphon.

Testá interná, oblongá, semiconicá, apice deorsum inflecto et in umbonem obtusum, foramine perforatum, dilatato ; parte anteriori in cavitatem semiconicam, profundam, ad foramen tendentem, et septa transversa, siphone ventrali perforata, continentem, excavatá ; caritatis superficie duobus laminis conicis, pertenuibus, circa septa productis et ea involventibus, obtectá.

The remarkable remains for the reception of which I propose the present genus are described by Mr. J. Sowerby in the 'Mineral Conchology,' and are referred by that author to *Beloptera*. M. Deshayes, in the first instance, in the 'Description des Coquilles fossiles, &c.,' expressed an opinion that they could not be placed in that genus ; subsequently, however, in the notice of the genus *Beloptera*, introduced in the second edition of Lamarck, after speaking of *Belop. Levesquei*, he refers not only that

* Etym. Βελεμνον, telum ; ενωσις, conjunctio.

species but also the *Beloptera anomala* of Sowerby to the genus *Beloptera*, the principal character of which he states to be the association of a conical chambered cavity, similar to that of the *Belemnites*, with the beak (rostrum) of the *Sepia*. M. d'Orbigny also (*Moll. viv. et foss.*) refers to that genus the remains in question, which, he says, resemble *Beloptera Leresquei* in the absence of the lateral wings, but are distinguished from it as well by the want of the under part (the ventral paries) of the shell and of a distinct beak, as by the air-chambers being apparent on the under side. These remains unquestionably bear a close affinity to *Beloptera*; but the peculiarities they present appear to me to separate them distinctly from that genus, and fully to justify the establishment of a new genus for their reception.

The shell of *Belemnosis* consists of an elongated semiconical sheath, the apex of which expands into a short semicylindrical umbo, pierced on the ventral surface, and inflected towards the ventral aspect. The sheath is convex on the dorsal surface, and is without a ventral paries; the margins at the superior extremity are narrow, and present outwardly sharp edges, which extend rather more than one third of the length of the shell; as the margins approach the inferior extremity they expand, and the inner edges gradually become nearer to each other, until they unite immediately above the umbonal pore. The margins of the pore are elevated, and the pore itself penetrates to, and communicates with, the air-chambers. The septa are transverse and concave; the presence of a siphuncle and its ventral position are indicated by angular inflections on the sutural impressions along the medial line of the ventral surface; the septa are contained in, and wholly enveloped by, a thin conical sheath, which also is covered by a second and somewhat thicker conical layer lodged in the outer sheath.

The principal character of *Beloptera*, viz., the association of the elongated rostrum of the *Sepion* with the phragmocone of the *Belemnite*, fails in *Belemnosis*; and the lateral expansions which, assuming their fullest development in *Beloptera Belemnitoidea*, still characterise *B. Leresquei*, although reduced in that species to prominent carinae, are here wanting, or, at the utmost, are but feebly represented by the sharp outer edges of the ventral margins of the sheath. In *Beloptera*, the outer cone, which contains the inner sheath and its contents, and which exactly corresponds with the phragmocone of the *Belemnite*, is entire; whereas, in *Belemnosis*, the ventral paries is wanting, or very thin. In this respect *Belemnosis* presents an analogy with *Belemnitella* (D'Orb.), a genus of the *Belemnitidae*, characterised by a fissure in the phragmocone communicating with the external paries of the alveolus. This peculiar form of *Belemnite* at present appears to be confined to the upper chalk formation, and it would seem to connect the true *Belemnite* with the present genus, in which the fissure becomes largely expanded, resembling the wide cavity of *Belosepia*. Thus the transition from *Belosepia*, through *Belemnosis* and *Belemnitella*, into *Belemnite* will be easy and natural, and the chain of connexion between the latter genus and the recent *Sepia* will be complete.

The principal character, however, which distinguishes *Belemnosis* is the aperture forming a communication between the alveolar chambers and the sac in which the shell was lodged. In all the camerated siphoniferous shells, I believe without exception, the inferior extremity of the alveolus and phragmocone is perfectly closed, and the air-chambers have not any direct communication with the pallial sac; and, in fact, communicate only with the pericardial cavity by means of the membranous siphuncle. Walch, it is true, in his 'Recueil de Monumens, &c.,' figured a Belemnite, which he described as having a small circular hole at the extremity of a curved point; upon which figure, with embellishments of his own, De Montfort proposed the genus *Paclites*, referred to by Parkinson, and quoted by De Blainville. This genus, however, is universally rejected, as founded on characters merely accidental or imaginary. M. d'Orbigny states, that in certain exceptional cases the extremities of the rostra of Belemnites, at the last period of their growth, form tubular prolongations, and that they are also liable to distortion from accident. The extreme points of the successive layers, which form the spathose guard, are apparently, in some instances, more susceptible of disintegration than the other parts, and thus tubular openings may be formed along what Voltz terms the *apical line*. But in all these cases the pore is merely terminal, and does not extend far up the sheath. The structure found in *Belemnosis*, therefore, appears to be peculiar to it; and would indicate an application of the siphuncular function, whatever that function may be, different from that in all other siphoniferous shells, and suggests a corresponding peculiarity in the organization of the animal.

From the absence of the elongated rostrum which characterises the *Belosepia* and *Beloptera*, we infer that the animal of *Belemnosis* was not littoral in its habits, but existed in a comparatively deep sea; and the occurrence of the unique specimen, upon which the genus is founded, at Highgate, where the organic remains indicate a shallow-sea deposit, is attributable most probably to the casual drifting of the animal.

No. 6. BELEMNOSIS PLICATA. *F. E. Edwards*. Tab. 2, fig. 3a—e.

BELOPTERA ANOMALA; *Sowerby*. 1829. Min. Con. vol. vi, p. 183, tab. 591, fig. 2.

— — *Morris*. 1843. Cat. of Brit. Foss. p. 178.

— — *Pictet*. 1845. Traité élément. de Paléont. tom. ii, p. 316.

— — *Deshayes*. 1845-6. 2d Edit. de l'Hist. Naturelle, &c. par Lam.

— — *D'Orbigny*. 1845-7. Moll. viv. et foss. tom. i, p. 309, tab. 14, figs. 8-10.

B. testá oblongo-elongatá, supra convexá, umbone obtusissimo, lateraliter compresso, et deorsum leviter inflecto terminatá: marginibus ventralibus anticè depressis, posticè sub-converis, facies externas acutas, internas, obliquè triplicatas, præbentibus: foramine umbonali circulari.

This shell is oblong, regularly convex on the upper surface, and terminated by a very obtuse, short umbo, compressed laterally, and slightly inflected towards the ventral aspect. The ventral margins are depressed, and present outwardly sharp edges, which extend rather more than one third of the length of the shell; the margins assume a convex form as they approach the inferior extremity, and at about two thirds of the length, become and continue nearly parallel until their union above the umbonal pore. The inner edges present three obscure, very oblique folds, from which character the specific name is taken. The umbonal pore is circular, and extends to the pyrites, with which the phragmocone is filled; it is about one fourth of the breadth of the shell in diameter. The septa are distant.

This unique and valuable specimen enriches the cabinet of Mr. Sowerby, whose kindness in conceding the use of it for description I beg to acknowledge. It was found in the clay removed in constructing the archway at Highway.

The length is .5 in.; the breadth at the upper extremity is .25 in., and across the umbonal pore .15 in.

ORDER—*TETRABRANCHIATA*. Owen.

Family—*NAUTILIDÆ*.

According to Von Buch, the division, which has been made of the tetrabranchiate Cephalopods into the two great families *Nautilidæ* and *Ammonitidæ*, has been determined solely by the position of the siphuncle, which, in the latter family, is invariably placed on the *ventral* margins of the septa; while, among the *Nautilidæ*, it is placed at or near the *centre* of the discs of the septa. Other differences exist in the form and condition of the septa, which, among the *Nautilidæ*, are characterised by simple curvatures or undulations, and by having their margins entire; while, among the *Ammonitidæ*, the septa present a series of lobes or sinuous flexures, the margins of which are foliated.

A third group, however, exists, in which the siphuncle is placed on the *dorsal* margin, and the septa are distinguished by angular or rounded lateral lobes, but their margins are perfectly simple. This group, for the typical forms of which Count Münster established the genus *Clymenia*, has been hitherto generally associated with the *Nautilidæ*; but I propose to separate it as a distinct family, under the name *Clymenidæ*.

The *Nautilidæ* will then be confined to those genera in which the siphuncle is *central* or *excentric*, that is, placed at the centre of the disc of the septum, or between that and the margin; or, more strictly, to those in which it is not placed either on the ventral or on the dorsal margin.

As thus restricted, the *Nautilidæ* will consist of the following genera: *Nautilus*,

Planulites, Lam., *Gyroceras*, *Lituitus*, *Campulites*, Desh. (*Cyrtoceras*, Gold.), *Phragmoceras*, *Orthoceras*, *Actinoceras*, *Koleoceras*, Portl., and *Poterioceras*, M'Coy (*Gomphoceras*, Sow.)

Of these genera, the *Nautilus* only has been found above the secondary formations.

The generic distinctions are taken chiefly from the position of the siphuncle, and the mode of convolution or the form of the shell.

Genus 4. NAUTILUS—*Gualtieri*, Linnæus.

OCEANUS; BISIPHITES. *De Mont.*

OMPHALIA. *De Haan.*

Gen. desc. Animal; *body* oblong, posteriorly rounded, and terminating in a slender membranaceous tube; *head* above, with an ambulatory disc; *arms*, nineteen (?) on each side;* *labial tentaculiferous appendages*, four, arranged round the mouth; *tentacula* of three kinds, viz. *ophthalmic*, lamellose, two on each side; *brachial*, annulose, twenty on each side; *labial*, annulose, twenty-four on each side; the whole body contained in the last chamber of a large multilocular shell, and affixed by two lateral muscles.

Shell; discoidal, spiral, multilocular, with simple walls; the whorls contiguous, the last covering the others; septa transverse, concave without, perforated in the disc, margins quite simple.

Animal corpore oblongo, postice rotundato, tubo gracili membranaceo terminato; capite supra disco ambulatorio; brachiis utrinque novemdecem; (?) appendicibus labialibus tentaculiferis, quatuor, circum os dispositis; tentaculis trium generum, quorum, ophthalmicis, lamellosis, utrinque duobus; brachialibus, annulosis, utrinque viginti; labialibus, annulosis utrinque viginti quatuor; toto corpore in camerâ ultimâ testæ magnæ multilocularis recondito et musculis duobus lateralibus affixo.

Testâ discoidê, spirali, polythalamîâ, parietibus simplicibus; anfractibus contiguis, ultimo alios obtegente; septis transversis, extis concavis, disco perforatis, marginibus simplicibus.

The *Nautilus* is the only genus of the Cephalopoda which, appearing among the earliest forms of animal life, has survived the various changes which the earth has undergone. The large family, of which it forms the type, flourished during the Palæozoic epoch, and the *Nautilus* itself apparently attained its fullest development during the deposition of the carboniferous series, at which period nearly fifty species existed. Gradually diminishing in numbers, the genus passed through the Mesozoic epoch into the tertiary era, which it has also survived; and though reduced to four species, which have not any fossil representative,† it still exists in the tropical seas.

* M. Valenciennes states the number to be seventeen.

† The identification of the species in the Miocene formations of Turin cannot be relied upon.

The Nautilus appears to have been known to Aristotle, of whose shell-bearing polypi, the second is considered to be the Nautilus Pompilius; the first species, the true Nautilus of the ancients, and to which Gualtieri gave the name *Cymbium*, is the *Argonauta* of Linnaeus. Although the shell of the recent Nautilus has long been commonly known, little information existed as to the animal, beyond that given by Aristotle, until a comparatively recent period. At the beginning of the last century the Dutch naturalist Rumph drew the attention of zoologists to the animal of the Nautilus; a description of which, illustrated by figures, he gave in his work 'D Amboinische Rariteitkamer.' From Rumph's description, which, however imperfect, was more intelligible than his drawing, De Montfort gave an imaginary representation of the animal, wide of the truth, but which was adopted by Shaw. After the time of Rumphius not any additional information was procured until the arrival in England, in 1831, of a specimen of the *Nautilus Pompilius*, taken by Mr. Bennett in Marachini Bay on the south-west side of the island of Erramonga, one of the New Hebrides. It is true that in the preceding year MM. Quoy and Gaimard had published, in the 'Annales des Sciences Naturelles,' an account of a portion of some unknown molluscous animal, which they supposed to be the *Nautilus Pompilius*, found near the island of Celebes; but the remains were too imperfect for satisfactory description, and, in fact, they have generally been attributed to a Heteropodous Mollusc, either Carinaria or Pterotrachea. The specimen brought over by Mr. Bennett was placed in the hands of Professor Owen, who in 1832 published his Memoir before referred to with minute anatomical descriptions and illustrations. In 1839 M. Valenciennes published an account entitled 'Nouvelles Recherches sur le Nautilé flambé,' taken from an individual transmitted to the Museum of Natural History at Paris. These two works afford ample information as to the animal, but it is unnecessary to enter into the details, a brief outline, sufficient for the present purpose, having already been given. Of the soft parts of the animals which inhabited the fossil shells, no trace has been found to assist the Palæontologist, who must, therefore rely wholly on the calcareous remains for specific distinctions. As regards the tertiary species, these distinctions appear to be tolerably well defined; and but little difficulty will be found in the determination of the species.

The shell is smooth, spiral, and symmetrical; suborbicular, or somewhat depressed, and more or less round on the ventral aspect; the margins of the aperture are smooth and simple; the whorls are contiguous, and convoluted in a vertical plane, the last being the largest and concealing the rest, by which character it is distinguished from *Planulites*, the whorls of which are exposed. In some species the umbilicus is open; but more generally it is closed, as in the adult specimens of the recent *N. Pompilius*, by a deposition of nacreous or calcareous matter. The lines of growth are distinct, and in some species strongly marked, giving a somewhat striated appearance to the shell; and they are reflected backwards, in which respect they differ from those of the *Ammonitidæ*,

which are bent forwards. The chambers are separated by transverse partitions, more or less undulated; and in one species, *N. Parkinsoni*, they are distinguished by lateral angular lobes, resembling those of *Aturia* (*Nautilus*) *zic-zac*, and the margins are invariably simple and entire. The discs of the septa are perforated at the centre, or at parts more or less distant from the margins, but never at the margin, by a calcareous siphuncle, variable in size and generally discontinuous, that is, extending more or less into the preceding chamber, but not into the preceding siphuncular aperture. The chambers themselves increase in size to the last, which is sufficiently large to contain the whole of the animal; but the ratio of increase is apparently uncertain, and is influenced probably by the growth of the animal, which would, of course, depend on the supply of food and other circumstances.

The fossil substances termed *Rhyncholites*, which occur so frequently in the older formations, and which are generally believed to be the mandibles of some of the Tetra-branchiate Cephalopods, with whose remains they are associated, have been found both in the Paris basin and in the tertiary formations in Belgium; but I believe that as yet they have not been found in the Eocene strata of England.

The specific characters in this genus are taken from the curvature of the septa, the general outward form of the shell, (which, in fact, determines the shape of the septum,) the position of the siphuncle and the condition of the umbilicus. With respect to the terms *dorsal* and *ventral*, it must be borne in mind that they are used in the following descriptions in a sense directly the reverse of that in which they have been generally applied. The *Nautilus*, in its normal position, rests upon, or creeps along the ground by means of, the free and expanded anterior portion of the mantle. In this position the back of the animal is against the penultimate whorl of the shell, and the ventral part is contained within the concavity of the dwelling-chamber. In the following descriptions, therefore, the term *dorsal* is used to designate the parts contiguous to the penultimate volution of the shell, and which have been generally, though incorrectly, described as ventral; and the term *ventral*, on the other hand, will be applied to those parts on which the belly of the animal rested, and which hitherto have usually been termed dorsal.

At present six species have been found in the tertiary strata of England, and they are confined to the older Eocene deposits. In the contemporaneous strata of the Paris basin two species occur, one of which is also found in Belgium; but not either of them has as yet been found in England; and four species have been described by Sismonda and Michelotti, as occurring in the Miocene formations in Piedmont. Two of these last species are referred by those authors to existing species; but the accuracy of the identification is questioned.

No. 7. NAUTILUS CENTRALIS. *Sowerby*. Tab. III, fig. 1a—c.

NAUTILUS CENTRALIS. *J. Sow.* 1812. Min. Con. vol. i, p. 11, tab. 1, left-hand figure.

— AUSTRALIS (by error for CENTRALIS). *Defrance.* 1825. Dict. des Sc. Nat. vol. xxxiv, p. 297.

— CENTRALIS. *Wetherell.* 1836. Philos. Mag. and Journal, vol. ix, p. 465.

— BUCKLANDI. (?) *Michelotti.* 1840. Ind. rag. di alcuni Testacei de Cefal. foss. &c. Ann. delle Scien. del Regno Lomb.-Veneto, p. 4.

— CENTRALIS. *Morris.* 1843. Cat. Brit. Foss. p. 182.

— — *Pictet.* 1845. Traité élément. de Paléont. vol. ii, p. 338.

— — *Sow.* 1849. Dixon's Geol. Hist. &c. pp. 110, 121, tab. 14, fig. 28.

N. testá globosá, in aspectu ventrali rotundatá; aperturá semilunari; umbilicatá, umbilicis angustis, profundis; septis extús concavis, simplicissimis, siphone centrali, minimo, continuo perforatis; lobis dorsalibus latis, haud reflexis.

The *N. centralis*, in the simplicity of the septa and the central position of the siphuncle, nearly resembles the recent Nautili. It is a very ventricose, almost a globose shell, much rounded on the ventral aspect; the aperture is bluntly lunate, nearly semicircular, and is rather more than twice as wide as it is long; the open umbilicus is narrow and deep; the septa are concave outwardly, and simple, scarcely presenting any undulation or second curvature whatever: the dorsal lobes are broad, each being nearly one third of the width of the aperture, and they are bluntly rounded on their superior margins; the siphuncle is very small, central, or nearly so, and continuous. The lines of growth present broad undulations, and are strongly marked and decussated.

Michelotti has described a Nautilus from the Miocene formations of the Colle de Torino, in Piedmont, to which he has given the name *Bucklandi*. He quotes *N. centralis* of Sowerby by the name *N. australis* (an error into which he has fallen by relying on Defrance's quotation), and he considers his shell to be identical with it, and, oddly enough, associates with it *N. imperialis*. The specific description given by this author agrees tolerably well with that of the present species; but I have not myself had any opportunity of comparing the Piedmontese with the English shell; and as Michelotti does not mention his having compared the two, and he appears to have trusted implicitly to Defrance, the accuracy of the identification must for the present be considered as doubtful.

Mr. Wetherell, in his paper above quoted, gives this species and *Naut. regalis* as characteristic of the middle division of the three which he thinks might be made of the true London Clay. It occurs at Regent's Park, Chalk Farm, Hyde Park, Richmond, Sheppy, and Bognor; it is also found, though very rarely, at Bracklesham Bay.

The species does not appear to have attained a great size, the largest specimen not exceeding 3·7 in. in diameter, by 3·3 in. across. The figs. 1 and 2, Tab. III, are taken from specimens in the collection of Mr. Wetherell; fig. 3, from one in that of Mr. Sowerby. The form of the septum is shown by fig. 2, Tab. VIII.

No. 8. NAUTILUS REGALIS. *Sowerby*. Tab. IV.NAUTILUS REGALIS. *J. Sow.* 1823. *Min. Con.* vol. iv, p. 77, pl. 355.— — *Def.* 1825. *Dict. des Sc. Nat.* vol. xxxiv, p. 300.— — *Weth.* 1836. *Philos. Mag. and Journ.* vol. ix, p. 465.— — *Morris.* 1843. *Cat. Brit. Foss.* p. 183.— — *Pictet.* 1845. *Traité élément. de Paléont.* vol. ii, p. 338.— — *Sow.* 1849. *Dixon's Geol. Hist. &c.* p. 120.

N. Testá lævigatá, sub-ventricosá, in aspectu ventrali compressá, obscurè undulatá; aperturá obtusè-ellipticá; umbilicis obtectis; septis simplicibus, concavis, utroque latere perparum undulatis, siphone sub-centrali perforatis; lobis dorsalibus brevibus, rotundatis, haud reflexis.

The present species is distinguishable from the preceding by the closed umbilicus, and by its general form, which is less ventricose than that of *N. centralis*. It is a smooth shell, flattened on the sides, and bluntly rounded, and obscurely undulated on the ventral aspect. The aperture presents a subquadrate appearance. The umbilicus is closed by a thickening of the lip, assuming the appearance of a solid axis to the shell. The septa are nearly simple, presenting on each side slight undulations, and the short, rounded dorsal lobes are deeply concave, and not reflected. In the young shell the septum is characterised by a conical depression placed on the dorsal margin close to the preceding whorl; as the shell enlarges this gradually decreases in size and depth, and ultimately disappears. It was of course moulded on a corresponding protuberance on the animal, probably an enlargement of the epithelial cincture. In some species the cavity is very deep. It was on this character that De Montfort, mistaking the depression for the mouth of a second siphuncle, founded his genus Bisiphites. The siphuncle is small and excentric. The lines of growth, like those of the preceding species, are decussated, and reflected backwards in broad undulations.

The *Nautilus regalis* attained a large size. The specimen figured, for the use of which I am indebted to Mr. Dixon, measures 9·5 in. in diameter, by 5 in. across. The species occurs at Islington, Regent's Park, Chalk Farm, Hyde Park, and at Bognor. It appears to have been one of the most common of the English Eocene Nautili. The septum is represented at Tab. VIII, fig. 5.

No. 9. NAUTILUS URBANUS. *Sowerby*. Tab. III, fig. 2 *a—b*.NAUTILUS URBANUS. *J. D. C. Sowerby.* 1843. *Min. Con.* vol. vii, p. 36, pl. 628.— — *Morris.* 1843. *Cat. Brit. Foss.* p. 183.— — *Pictet.* 1845. *Traité élément. de Paléont.* vol. ii, p. 338.

N. Testá discoideá, in aspectu ventrali rotundatá, et obscurè undulatá; umbilicatá; aperturá subquadratá, elongatá; septis oblongis, concavis, in utroque latere leniter undulatis et siphone excentrico perforatis; lobis dorsalibus perbrevis, obliquè truncatis, haud reflexis.

A flat discoidal shell, rounded on the ventral aspect, and presenting obscure undulations similar to those which characterise *N. regalis*. The aperture has an elongated, subquadrate shape; the umbilicus is narrow; the septa concave, and slightly undulated; they present on each side, in a line with the preceding whorl, a slight depression, which appears to be the first indication of the lateral lobes so fully developed in the *N. Parkinsoni*; the siphuncle is excentric approaching the dorsal margin; the dorsal lobes are short, very slightly concave, obliquely truncated, and not recurved. The lines of growth are prominent, and decussated more strongly than those of the two preceding species, and their undulations are broad and shallow.

The *Nautilus urbanus* is distinguishable from *N. centralis* by its flatness, and the greater length of its aperture; and from *N. regalis* by its open umbilicus, the truncated extremities of the dorsal lobes of the septa, and its discoidal shape. It is a very rare shell. The figures 2*a*, 2*b*, Tab. III, are taken from the shells drawn in 'Mineral Conchology,' the only specimens with which I am acquainted. The larger one, belonging to Mr. Sowerby, was found in excavating St. Katharine's Docks, near the Tower of London; the smaller one forms part of Mr. Bowerbank's collection, and was obtained from Sheppy.

The size of the larger individual figured is 7·4 in. in diameter, by 3·4 in. Fig. 4, Tab. VIII, represents the septum.

No. 10. NAUTILUS IMPERIALIS. *Sowerby*. Tab. V.

NAUTILUS IMPERIALIS. *J. Sow.* 1812. Min. Con. vol. i, p. 9, tab. 1, upper and right-hand figures.

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| — | — | <i>Defrance.</i> 1825. Dict. des Sci. Nat., tome xxxiv, p. 297. |
| — | — | <i>Wether.</i> 1836. Philos. Mag. and Journ. vol. ix, p. 465. |
| — | BUCKLANDI. | <i>Michelotti.</i> 1840. Indice ragionato, &c. p. 4. |
| — | IMPERIALIS. | <i>Morris.</i> 1843. Cat. Brit. Foss. p. 182. |
| — | — | <i>Pictet.</i> 1845. Traité élément. de Paléont. vol. ii, p. 338. |
| — | — | <i>Sowerby.</i> 1849. Dixon's Geol. Hist. &c. pp. 110, 120. |

N. Testá sphæroidale; umbilicatá, umbilicis angustis, profundis; aperturá sub-ellipticá, semilunari; septis undatis, siphone mediocri dorso-excentrali perforatis; lobis dorsalibus latis et perparum reflexis.

This species is easily distinguished from the *N. centralis* by the excentric position of the siphuncle, as well as by the broad and reflected extremities of the dorsal lobes, which form, as it were, an axis to the shell. Its orbicular form, the lunate shape of the septa, and the recurved dorsal lobes, distinguish it as clearly from *N. regalis* and *N. urbanus*.

The *Nautilus imperialis* is a somewhat globose shell, rather narrow on the ventral aspect, whence the aperture assumes a sub-elliptical form; the umbilicus is small and deep. It is well displayed in the large figure, Tab. V, taken from a specimen in Mr. Bowerbank's collection, but generally, it is found open only in young shells; in the larger specimens it is usually filled with pyrites or indurated clay. The septa are deeply concave, and present a gentle undulation on each side; the dorsal lobes are very broad, inflected towards the axis, and obliquely truncated on the inferior margins. The siphuncle is moderately large, and excentric, being placed on the dorsal side of the centre of the disc. It appears to vary in its position, gradually becoming more distant from the dorsal margin as the shell enlarges. The lines of growth are reflected backwards in a deep narrow wave, and in the specimens I have seen are not decussated as in the three preceding species.

In the shell described by Michelotti under the name *N. Bucklandi*, and with which he has associated the present species, the siphuncle is central; and that character is, in fact, the reason assigned by him for considering his shell to be identical with *N. centralis* as well as with *N. imperialis*. Whether the alleged identification of *N. Bucklandi* with *N. centralis* be correct or not, it is obvious that the Piedmontese shell cannot be referred to the present species. Defrance states that the *N. imperialis* did not appear to differ from *N. centralis*, and Michelotti has, in fact, relied implicitly on that author; he has even copied the mistake made in quoting *N. centralis* as *N. australis*.

The *N. imperialis* attained a very large size; a specimen from Sheppy in the Museum of the Geological Society measures 12 inches by 8·75 in. across. It appears to have been widely spread, being found at Highgate, Hornsey, Brentford, Sheppy, Cuffell near Basingstoke, Clewett's Green, Newnham, Bognor, and Bracklesham. The form of the septum is shown in Tab. VIII, fig. 1.

NO. 11. NAUTILUS SOWERBYI. *Wetherell*. Tab. VI.

NAUTILUS SOWERBYI.	<i>Weth.</i> 1836. Phil. Mag. and Journ. vol. ix, p. 466.
— —	<i>Morris.</i> 1843. Cat. Brit. Foss. p. 183.
— —	<i>Sow.</i> 1843. Min. Con. vol. vii, p. 35, pl. 627, fig. 1-3.
— —	<i>Sowerby.</i> 1849. Dixon's Geol. Hist. &c. p. 121, tab. 14, fig. 28.

N. Testá lævigatá, lenticulari, ventrali aspectu angustè rotundatá; umbilicatá, aperturá sub-triangulari; septis profundè concavis; siphone continuo, prope margines dorsales posito, perforatis; utroque latere latè undulosis et sublobatis; lobis dorsalibus elongatis, valdè reflexis, obliquè truncatis.

The *N. Sowerbyi* is an exceedingly well-marked species. It is a smooth, discoidal, convex or rather lenticular shell, somewhat resembling in shape the Dax form of

Aturia (*Nautilus*) *zie-zae*, but it is narrower towards the margin, which circumstance gives a triangular form to the aperture. The septa (Tab. VIII, fig. 3) are very concave, and present on each side a broad undulation, with a deep sinus-like depression caused by a lateral lobe, more developed in this species than in *N. urbanus*, although not attaining the size and importance of that which distinguishes *N. Parkinsoni*.

The dorsal lobes are much recurved and obliquely truncated; the siphuncle is moderately large, placed very near to the dorsal margin, and continuous. The striæ of growth towards the middle are suddenly bent backwards in deep undulations.

This species, which attained a size of 10 inches in diameter by 4·2 in. across, was first obtained by Mr. Wetherell from the tunnel made at Chalk Farm for the Birmingham Railroad. It has also been found in the cuttings now in progress between Whetstone and Barnet for the Direct Northern Railroad, and it occurs at Sheppy and at Bognor, where it is very common.

NO. 12. NAUTILUS PARKINSONI. *F. E. Edwards.* Tab. VII.

NAUTILITE. *Parkinson.* 1811. *Organic Remains*, p. 105, pl. 7, fig. 15.

N. testá discoideá, aperturá elongato-ellipticá, parietibus convexis; umbilicis(?); septis extis concavis, in utroque latere angulariter lobatis, siphunc, prope margines dorsales posito perforatis; lobis lateralibus brevibus, subtriangularibus, macronatis; lobis dorsalibus latis, perparum concavis, ad extremitates attenuatis, reflexis.

Parkinson, in his work above cited, described the remains of a *Nautilus*, purchased by him at the sale of Dr. Menish's collection. These remains, which consist of the casts of three chambers, afterwards came into the possession of Mr. Sowerby, who has placed them at my service. Parkinson was ignorant of the locality whence they came; but from their mineralogical character, the matrix being, in fact, the substance known as cement-stone, it was supposed that they were found at Harwich. Lately the Rev. Thomas Image, of Whipstead, near Bury St. Edmunds, has forwarded to me for examination similar remains, unquestionably obtained at Harwich, and consisting of the casts of two chambers, rather smaller than those in Parkinson's specimen, and in a matrix precisely similar. The question, therefore, as to the locality of Parkinson's specimen is set at rest.

These remains are particularly interesting, from the circumstance that in them the angularly-lobed septum which characterises *Aturia* (*Nautilus*) *zie-zae*, and in that shell is accompanied by a strictly dorsal siphuncle, is associated with one which, although very excentric, is still so truly discal, as to prevent the shell being removed from the present genus. The form of the septum is a good specific character, but it cannot be relied upon as a generic distinction. The *Nautilus Parkinsoni*, therefore, although in general appearance it closely resembles *Aturia*, must, in fact, from the position of the siphuncle

be considered as an aberrant *Nautilus*, connecting that genus with *Aturia*, and leading through the *Clymenidæ* into *Goniatites* and *Ammonites*.

The *N. Parkinsoni* is a discoidal shell, with regular convex sides, and an elongated elliptical aperture. The specimens do not exhibit the condition of the umbilicus. The septa are outwardly moderately concave, with angular lobes on each side; the dorsal lobes are very broad, somewhat concave, rounded at the extremities, and reflected, although not much, towards the axis; the lateral lobes are short, wide at the upper extremities, and they taper rather suddenly; their inferior margins are nearly straight, but the superior margins present a deep sinus. The siphuncle is moderately large, and is placed on the dorsal part of the septal disc, half way between the centre and the margin. So far as the general character can be ascertained, the siphuncle does not appear to differ from that of *Nautilus*, and certainly does not present any analogy with the wide trumpet-mouthed funnel which distinguishes *Aturia*.

This species appears to have attained a greater size than any other of the tertiary Nautili; the largest chamber in Parkinson's specimen measures seven inches in breadth, and nine inches in length; and this chamber was not the last, and consequently not the largest.

Family—CLYMENIDÆ.

AGANIDÆ. *Pictet, Deshayes, D'Orbigny.*

Adopting the opinion of Von Buch, that the position of the siphuncle is the principal, if not the only, character by which the Tetrabranchiate Cephalopods can be divided into families, it becomes impossible to include those genera in which the siphuncle is placed on the *dorsal* margin, either among the Nautilidæ, in which it is *central* or *excentric*, or among the Ammonitidæ, in which it is placed on the *ventral* margin. The only genera at present known to possess a strictly dorsal siphuncle, are *Clymenia*, Munst. (*Endosiphonites*, Ansted), and *Aturia*, a genus proposed by Bronn for the *Nautilus Aturi*, Basterot (*N. zie-zac*, Sow.) In fact, these genera have already been considered by MM. d'Orbigny, Deshayes, and others, to form a subdivision of the Nautilidæ, to which those authors have applied the name Aganidæ, founded on a genus proposed by De Montfort for a shell from the mountain limestone. This shell, however, possessed a ventral siphuncle, and belonged to the genus *Goniatites*.* The name *Aganidæ*, therefore, cannot with propriety be retained as a family name for genera characterised by a *dorsal* siphuncle; and I have adopted, in lieu of it, the name *Clymenidæ*, founded on Munster's genus.

* The shell figured and described by De Montfort as *Aganides* is, I believe, the *Goniatites sphaericus* of Sowerby.

The septa in the *Clymenidæ* are distinguished by lateral rounded or angular lobes ; but the angular form is not peculiar to the family ; since, as we have already seen, it is found in *Nautilus Parkinsoni*, a species which, possessing an excentric siphuncle, must be considered as merely an aberrant form of *Nautilus* ; and the separation of the *Clymenidæ* will depend entirely on the siphuncle being placed on the dorsal margin.

The two genera which belong to this family are distinguished chiefly by the mode of involution of the shell ; the whorls in *Clymenia* being exposed, while in *Aturia* the last whorl conceals the rest ; they therefore bear to each other the same relation which *Planulites* bears to the true *Nautilus*.

Genus 5th. *ATURIA*.* *Bronn, 1837.*

Gen. desc. *A. testá discoideá vel subventricosá, spirali, multiloculari, parietibus simplicibus ; anfractibus contiguis, ultimo alios obtegente ; umbilicis clausis ; septis transversis, numerosis, extus concavis, utroque latere angulariter lobatis et parte dorsali, magná siphone infundibuliformi, marginibus positá, retro prolongatis ; marginibus simplicibus.*

Shell discoidal or subventricose, spiral, multilocular, sides simple ; whorls contiguous, the last concealing the others ; the umbilicus closed ; septa transverse, numerous, concave outwardly, with an angular lobe on each side, and having the dorsal part prolonged backwards, forming a large, marginal, funnel-shaped siphon ; margins of the septa entire.

The angularly-lobed septum which distinguishes *Nautilus Parkinsoni* also forms a prominent character in the well-known Highgate fossil, *Nauf. zic-zac*, figured and described by Mr. Sowerby in the first volume of the ‘Mineral Conchology.’ *Bronn*, in his description of the Dax shell *Nautilus Aturi* (Bast.), which he considered to be distinct from *N. zic-zac*, suggested the propriety of forming a sub-genus, to be called *Aturia*, for the reception of those tertiary Nautili in which, according to the sub-generic description given by him, “the siphon is sub-ventral (i. e. sub-dorsal), and the septa have a deep, narrow, lancet-shaped flap on each side.” The siphuncle, however, in the Dax shell, on which the genus is founded, is, in fact, strictly *marginal* ; it is, as *Bronn* himself describes it, a prolongation backwards of the dorsal part of the septum, in the shape of a wide-mouthed funnel, extending quite across the preceding chamber, and deeply into the mouth of the preceding funnel. As this funnel-shaped siphon decreases in diameter, the dorsal paries gradually recedes from the margin, and the intervening space is filled up with a calcareous deposit. The siphuncle, therefore, will in some parts of its extent appear to be sub-marginal only : whereas the mouth of the

* Etym. *Aturrus vel Aturus*—the River Adour.

siphuncle, by which only the position can be determined, is perfectly marginal. The *Nautilus Aturi*, which I consider to be identical with *Nautilus zic-zac*, is the type of Bronn's genus, and I therefore retain the name proposed by that author, although I do not assent to the accuracy of his generic description.

The genus *Clymenia*, proposed by Count Munster for certain Nautiliform remains occurring in the transition limestones of Fichtelgebirge, presents nearly the same characters as those assigned by me to *Aturia*; except that in *Clymenia* the whorls are exposed, and the siphuncle is described as narrow; whereas in *Aturia* the last whorl conceals the others, and the siphuncle, at least in *A. zic-zac*, the typical species, is of great size.

The genus appears to have been confined to the tertiary epoch, and it is widely diffused. It occurs in the Eocene formations of England, France, Belgium, and Germany; in the Miocene deposits in the basins of the Gironde, in Italy, and in Malta. It is also found in the Eocene formation in Clarke county, Alabama, (U. S.), and Conrad* mentions a cast from the contemporaneous formation near Long Branch, New Jersey, resembling *Nautilus (Aturia) zic-zac*, but more compressed, and which he has referred to De Montfort's genus *Pelagus*, and has named *P. Vanuxemi*. De Montfort's *Pelagus*, however, is described as having "cloisons lobées, persillées, dentelées, &c." The position of the siphuncle is not mentioned in De Montfort's text; but in the figure he has given it is placed on the ventral margin. The shell, therefore, on which the genus *Pelagus* is founded is an Ammonite, and the species constituting the present group cannot be associated with it.

No. 13. *ATURIA ZIC-ZAC*. Bronn. Tab. IX, fig. 1a—h.

Var. a. *NAUTILUS ZIC-ZAC*. Sow. 1812. Min. Con. vol. i, p. 9, pl. 1, fig. 3.

AMMONITES WAPPERI. Van Mons. 1833. L'Institut. 1833, p. 272.

— — — 1834. Bull. de l'Acad. de Brux. tome i, No. 17, pp. 113, 118.

NAUTILUS DESHAYESII. De Koninck. 1834. Notice sur un Moule pyriteux du Naut. de Desh.; Bull. Soc. Géol. de France, t. iv, p. 437.

— — — *Nyst*. 1835. Rech. sur les Coq. foss. de la Prov. d'Anvers, p. 35, No. 52.

— — — *De Koninck*. 1837. Desc. des Coq. foss. de l'Argile de Basele, p. 1.

— *ATURI*. Bronn. 1837. Leth. Geog. vol. ii, p. 1123, pl. 42, fig. 17a—c.

— *ZIC-ZAC*. Desh. 1837. Desc. des Coq. foss. des Env. de Paris, vol. ii, p. 765, pl. 100, figs. 2, 3.

CLYMENIA ZIC-ZAC. Michelotti. 1840. Annal. Scient. reg. Lomb. Venet. p. 6.

* Conrad's "Observations on the Eocene formation, and description of one hundred and five new fossils of that period, from the vicinity of Vicksburg, Mississippi," published in the Journal of the Academy of Natural Science of Philadelphia.

- NAUTILUS ZIC-ZAC. *Nyst.* 1843. Bull. Soc. Géol. de France, vol. xiv, p. 452.
 — — — 1843. Desc. des Coq. foss. &c. des Terr. tert. de la Belgique,
 p. 644, pl. 46, fig. 4.
 — — — *Morris.* 1843. Cat. Brit. Foss. p. 183.
 AGANIDES DESHAYESII. *Sismonda.* 1847. Method. Anim. invert. Pedemontii Foss. p. 57.
 — ZIG-ZAG. *Pictet.* 1845. Traité élément. de Paléont. Vol. ii, p. 341.
 NAUTILUS (CLYMENIA ?) ZIC-ZAC. *Sow.* 1849. Dixon's Geol. Hist. &c. p. 109, pl. 8, fig. 19.
 Var. β . NAUTILE DE DAX. *De Montf.* 1802. Buffon de Sonnini Moll. vol. iv, pp. 240, 252,
 pl. 46, fig. 1.
 NAUTILUS POMPILIUS. *Lam.* Ann. du Mus. vol. v, p. 181.
 — — — 1822. An. sans Vert. vol. xvi, p. 634.
 — DESHAYESII. *Defr.* 1825. Dict. de l'Hist. Nat. vol. xxxiv, p. 200.
 — ATURI. *Bast.* 1825. Desc. des Coq. foss. des Env. de Bordeaux, p. 17.
 ORBULITES ZIC-ZAC. *De Blainv.* 1825. Man. de Malac. p. 387.
 NAUTILUS (AGANIDES) ATURI. *D'Orb.* 1825. Tab. méthod. de la Classe des Céph. p. 71.
 — SYPHO. *Buckl.* 1836. Bridgw. Treat. vol. i, p. 357, pl. 46, figs. 1-4.
 — — *Grateloup.* 1838. Cat. des An. vert. et invert foss. du Basin de la
 Gironde, p. 28.
 AGANIDES ATURI. *Pictet.* 1845. Traité élément. de Paléont. Vol. ii, p. 341. ~

A. Testá ventricosá, lavigatá; umbilicis clausis; septis concavis; lobis lateralibus angustis, acutis; dorsalibus valdè recurvis; siphone magno, continuo, buccinæformi.

Var. β . *Testá compressá, sub-discoideá; septis profundè concavis, lobis dorsalibus angustioribus.*

Shell ventricose, smooth; umbilicus closed; septa concave; lateral lobes narrow, pointed; dorsal lobes much curved; siphuncle large, continuous, trumpet-shaped.

There are scarcely any tertiary remains which have excited so much attention as the present; not merely because the species is widely diffused, but because it presents an intermediate form between the Nautili and the Ammonites; and few fossils have been referred to more genera, or have been distinguished by a greater number of specific names.

The *Aturia zic-zac* was first described by Mr. Sowerby, sen., as *Nautilus zic-zac*, from a specimen which was found on forming the tunnel of the Highgate Archway. Several years afterwards M. Defrance described a specimen from the Paris basin, and pointed out the differences which, in his opinion, rendered it difficult to refer the species to the genus *Nautilus*. M. Defrance considered the fossil described by him as distinct from the *N. zic-zac*, and gave to it the specific name *Deshayesii*. Subsequently Basterot described the well-known Dax fossil, which he named *Naut. Aturi*, and with which he considered the *Naut. zic-zac* to be identical. M. d'Orbigny and Sig. Sismonda, not regarding the dorsal position of the siphuncle, but relying on the angular lobes which characterise the septa, have referred the shell in question to De Montfort's *Aganides*, a genus which, as has been before stated, was founded on a *Goniatite* from the mountain limestone. Michellotti, on the other hand, has considered

the present remains as forming part of Munster's *Clymenia*, a genus distinguished by its having the whorls exposed.

The *Aturia zic-zac* is a smooth, involute shell, more or less ventricose or depressed; the septa are outwardly deeply concave; and, owing to the regular curve in which the dorsal lobes are reflected towards the axis of the shell, they present, when viewed sideways, some resemblance to the letter S; the lateral lobes are more or less narrow, and taper rather suddenly towards the inferior extremity, which extends nearly to the preceding septum; but they are without the sinus which characterises the lateral lobes of *Naut. Parkinsoni*. The English shells are generally either casts in, or filled with pyrites, and it is difficult to ascertain the character of the siphuncle from them; but in the Dax shells, in which the calcareous siphon is frequently well displayed, it presents a structure widely different from that of the *Nautilus*. The dorso-marginal part of the septum, as I have before observed, is prolonged backwards in the form of a wide trumpet-mouthed funnel, which extends not only into the mouth of the funnel formed by the preceding septum, but along the preceding siphuncle almost to the floor of the third preceding chamber (see Tab. IX, fig. 2*a*). The calcareous siphuncle, therefore, is, in fact, a continuous tube of considerable thickness, composed of portions of two distinct tubes; and within this is contained a soft, friable, calcareous sheath, which commences near the extremity of the funnel, where it touches the preceding funnel, and extends to the end of the preceding funnel, to the interior surface of which it forms a sheath. Although, owing to the thickness of the walls and the presence of the calcareous sheath, the actual tube within which the membranous siphuncle was contained is not so capacious as might be expected from its external appearance, it is yet considerably larger than that of any of the tertiary *Nautili*; and indeed it is of such size and importance as fully to justify the name *Syphe*, which Grateloup has given to the Dax shell. The siphuncle in the English specimens, so far as its character can be ascertained, appears to correspond exactly with that of the Dax shells.

Great diversity of opinion has existed, and, in fact, still exists, as to the identity of the Dax shell with the *Naut. zic-zac* of Sowerby. The differences which have been relied on for the separation of the two appear to me to result from the more compressed form of the Dax shells; the specimen figured by Mr. Sowerby, although described as "flattish," being ventricose, and the outline of one of the septa drawn below the shell conveying the idea of greater fulness than in fact characterises the fossil. M. Deshayes, who compared the Dax shells with specimens as well from the Paris basin as from Belgian and English localities, expressed an opinion that the differences were sufficient to form, if not two species, at least two well-marked varieties. I have not myself had an opportunity of examining any French or Belgian specimens; but, through the kindness of Mr. Sowerby, Mr. Bowerbank, and Mr. Wetherell, who have afforded me the use of their specimens, I have before me a series of shells from Sheppy and the

neighbourhood of London, including the identical specimen figured by Mr. Sowerby. Confining myself to external characters only, two distinct forms occur in this series, the differences in which, although they may require a separation into varieties, are not sufficient, in my opinion, for specific distinctions.

In the first variety, which is the true *Naut. zic-zac*, figured in 'Mineral Conchology,' and which I have therefore taken for the typical form, the shell is ventricose, the greatest width being little less than half the diameter; it is moderately round on the ventral aspect, and the aperture is a somewhat elongated ellipsis. In the other variety (β) the shell is more compressed, almost discoidal; and consequently it is narrower on the ventral aspect; the dorsal lobes are not so broad, and the aperture is of a more elongated oval form.

The French, Belgian, and German shells correspond apparently with the first, the typical form, and the Dax shells agree closely with the second variety. Michellotti has used for the Piedmontese specimens the specific description given by M. Deshayes; but he adds, that "they present some trifling differences from the Paris specimens, as do the latter from the London and Bordeaux shells." As, however, the Piedmontese shells are described as "ventricose," they must for the present be referred to the typical form, although we should naturally expect to find the Dax type continued in the Miocene formations of the Colle de Torino.

The *Aturia zic-zac* also occurs in the Miocene deposits in Malta, and the specimens which I have seen from that locality present the depressed form of the Daxshells, with which they agree in other respects.

Mr. Sowerby possesses a series of casts from the Eocene formation in Clarke County, Alabama, of a species which approaches very near to the typical *Aturia zic-zac*; the chief distinction appears to be in the form of the lateral lobes, which in the American shell extend quite to the margin of the preceding septa, and have their extremities inflected towards the axis, and present the deep sinus which characterises the lateral lobes of *Naut. Parkinsoni*. The siphuncle is very large, and corresponds with that of *A. zic-zac*. Conrad describes his *Pelagus Tanuæmi* as more compressed than the latter shell, and he adds that "the angles of the septa appear to be in contact near the periphery." This appearance, which is attributable to the length of the lateral lobes, and is represented in the figure given by Conrad by a continuous line running parallel with the periphery of the shell, is also found in the Alabama specimens, of which Conrad's shell is possibly only a compressed variety.

The typical form, which is represented at Tab. IX, fig. 1a, 1b, drawn from the original specimen figured in 'Mineral Conchology,' for the use of which I am indebted to Mr. Sowerby, is found at Highgate, Sheppy, and Bracklesham Bay. The variety β , which corresponds with the Dax shells, was obtained from the railroad cutting at Chalk Farm, and from the well sunk for the use of the Orphan School, at Haverstock Hill,

near Hampstead. The specimen figured (Tab. IX, fig. 1*g*, 1*h*,) is from the former locality ; it is the one drawn by Mr. Charlesworth in the ' Magazine of Natural History,' vol. i, (new series,) p. 533, and forms part of Mr. Wetherell's valuable collection of fossils from Highgate and the neighbourhood.

The English shells are apparently young ; they are much smaller than the Dax specimens, the largest I have seen cannot have exceeded 1·6 in. in diameter.

52
Part II. Pulmonata. (Pl. 57-120. N. 8-XV). 1852.

A MONOGRAPH
OF THE
MOLLUSCA FROM THE EOCENE FORMATIONS
OF ENGLAND.

ORDER—*PULMONATA*. CUVIER.

PNEUMOBANCHIATA, Lamarck.

PULMOBRANCHIATA, De Blainville.

PULMONIFERA, Fleming.

THE Molluscs forming this order breathe the free air by means of a chamber termed the pulmonary sac or cavity, placed beneath the dorsal surface of the anterior part of the mantle, and communicating with the atmosphere by a lateral opening, which can be dilated or contracted at the pleasure of the animal. The roof and walls of this chamber are lined with a network of pulmonary vessels, by which the blood is exposed to the air, and the renewal of this vital fluid is effected by movements of the floor of the chamber, analogous with those of the diaphragm.

The Pulmonated Molluscs are furnished with eyes, which are either placed at the anterior extremities of two elongated cylindrical peduncles, or seated in the head of the animal. Most of the genera in which the eyes are pedunculated, are also furnished with shorter cylindrical tentacula, placed beneath the peduncles, but in some few instances these appendages are wanting. In the genera in which the eyes are sessile, the animal is furnished with two sub-cylindrical or compressed tentacles only. The sessile eyes are variously placed; in some genera they are seated at the inner sides of the bases of the tentacles; in others at the outer sides; and in others on the frontal disc. The peduncles and tentacles are both contractile, and in by far the greater number of genera they are also retractile, that is, capable of being withdrawn under the skin. They are eminently sensitive organs of touch.

The head is well developed, and the mouth is provided with an apparatus

consisting of a horny dentated plate, placed transversely across the upper part, and the sharp outer edge of which forms, as it were, the upper jaw. The cavity of the mouth is furnished with a thin cartilaginous tongue, the anterior extremity of which is of a flattened spoon-like form, and which plays against the edge of the horny plate, answering the purpose of an under jaw. The remainder of the tongue is rolled up into a tube closed at the end, and thickly covered with teeth, distributed in transverse rows of various forms. The number of these teeth is almost incredible, amounting, in one of the English slugs (*Limax maximus*) to nearly 27,000, and ranging in several of the snails from 10,000 to upwards of 20,000.* A dentition of a similar character prevails among the Branchiated Gasteropods; and Professor Lovén has proposed the employment, for the purposes of classification, of characters taken from the form and arrangement of the teeth.

The free air-breathing Molluscs are, in some few instances, viviparous,† but, for the most part, they are oviparous. The eggs are either enveloped in a skin, or are covered by a hard calcareous shell, which, among the larger *Bulimi* and *Achatinæ*, is sometimes of considerable size. The larvæ are in all cases shaped like the parent. The generative organs present various modifications; in some genera the animals are unisexual; but more generally they are hermaphrodite.

These Molluscs are, with few exceptions, provided with hard calcareous shells, which are sometimes either internal or partly concealed beneath the mantle, but more generally are external, and large enough to contain the whole, or nearly the whole, of the animal. In some genera the foot of the animal is provided with a calcareous or horny operculum; in others the animal is without this appendage, and in the genus *Clausilia*, the purpose of the operculum is answered by a peculiar apparatus termed the *clausium*. The external shells present many modifications in the proportions and conditions, as well of the spire and volutions, as of the aperture and columella. Certain of these forms are accompanied by corresponding peculiarities of organisation, and the genera which have been established for their reception may be considered types in this order; such are the genera *Helix*, *Bulimus*, *Pupa*, *Succinea*, *Limnæa*, *Physa*, *Planorbis*, *Cyclostoma*, *Helicina*, *Auricula*, &c., and the Palæontologist will have little difficulty in distinguishing them. Other genera, however, have been proposed from time to time on characters taken from modifications of these typical forms; but a more intimate acquaintance with the anatomy of the animals has latterly induced great caution in the admission of these genera; since, in many cases, the Malacologist, after the most careful investigation, has failed to detect any peculiarity of organisation corresponding

* For a more detailed account of the oral apparatus, the reader is referred to Mr. W. Thompson's highly interesting "Remarks on the Dentition of British Pulmonifera," in the 'Annals and Mag. of Nat. Hist.,' 2d series, vol. vii, p. 86.

† This is the case with some species of *Helix*, and with several species of *Bulimus*, for which Férussac, on this ground, proposed the genus *Partula*.

with the modifications of the shell. In the extensive family of the Helicidæ, most especially, has this occurred, and many of the genera thus formed are consequently either wholly rejected, or received provisionally until it is ascertained by further examination whether or not there is anything except merely artificial characters to support them.

The Gasteropods forming this order are all phytophagous. They are very widely spread, being found in almost all parts of the earth, but they principally abound in warm or tropical climates, where the largest species occur. They are, for the most part, inhabitants of land, but many live in water, coming to the surface for respiration; of those which live in water, the greater number inhabit ponds, running streams, or stagnant waters, but some few are marine animals, frequenting the shallow sea near the shores, or salt-water marshes.

Two distinct forms of the opening by which the communication between the pulmonary sac and the external air is kept up, are presented; and as each appears to be accompanied by corresponding peculiarities of organisation, Mr. Gray has availed himself of them for dividing the order into the two sub-orders, *Adelopneumona* and *Phaneropneumona*.* In the first division the communication is through a lateral orifice formed by the edge of the mantle, which, except at that part, is united along the left side of the animal; in the second division the edge of the mantle is free or detached along the nape, leaving the pulmonary cavity open. The animals comprised in the first division are all hermaphrodite, and without an operculum; while, on the contrary, those which form the second division are unisexual and operculated. The genera constituting this order had previously been divided, according to their habitats, into terrestrial and aquatic (*terricola* and *aquatica* of Dr. Fleming); a mode of distribution which brought together animals presenting important zoological differences. This principle of subdivision may, however, be used with convenience in the *Adelopneumona*, and Mr. Gray has, in fact, divided that sub-order into the three sections, *Geophila*, *Limnophila*, and *Thalassophila*, the last two representing the *aquatica* of Fleming.†

Mr. Webster many years ago, ('Geol. Trans.,' vol. ii,) noticed the occurrence in the Purbeck beds of fossils resembling fresh-water shells, and in the Museum of Practical Geology is a series of fossils from that formation, comprising *Limnæa* and *Planorbis*. Fossil remains, referred to the genus *Auricula*, have also been found, according to M. Nyst, in the chalk formation in the department of the Aube in France. In the

* Etym., *Αδηλος*, (hidden, concealed,) and *φανeros*, (open, exposed,) prefixed to *πνευμων*, (the lungs.) These sub-orders correspond with the divisions *inoperculata* and *operculata*, proposed by Férussac, and adopted by Dr. Turton, M. Rang, and others, but as the names used by Mr. Gray express modifications of the respiratory apparatus, which forms the character of the present order, I have adopted them, although the words *operculata* and *inoperculata* are preferable from their simplicity.

† Etym., *γεια* (land), *λιμνη* (a pool or marsh), and *θαλασση* (the sea), respectively prefixed to *φιλος* (loving).

fresh-water deposits of the Eocene epoch, remains of numerous species belonging to various of the land and fresh-water genera, constituting this order, occur in abundance. These species are, for the most part, without any living analogue, but some few occur which appear to be identical with species still in existence.

I believe that, as yet, remains of land inhabiting genera have not been found below the Eocene formations. It must not, however, be assumed from that circumstance that these latter forms of animal life date their existence with the Eocene Epoch. The older formations with which Geologists are at present acquainted, are, with the exception of the Wealden group and the Coal-measures, of marine origin; and the preservation in them of the remains of land-shells would be due only to accidental circumstances. Individuals might occasionally be transported by rivers or currents of water into estuaries, or be swept away by an irruption of the sea. To such a cause is to be attributed the presence of a specimen of *Bulimus ellipticus*, found by Mr. Wetherell in the London Clay at Primrose Hill; but the number deposited in the bed of the deep sea by the agency of such casualties, must necessarily be small, and it need not excite surprise that their remains have not occurred in the older formations.

SUB-ORDER—*ADELOPNEUMONA* (Gray), *INOPERCULATA* (Férussac).

Sect. α. *TERRICOLA*, *Fleming*.

GEOPHILA, *Férussac*.

Family—*HELICIDÆ*.

Genus 6th. *HELIX*. *Linn.*, 1758; *Brug.*, 1792; *Lam.*, 1801.

Shell turbinated, orbicular, sub-globose, or depressed; spire more or less elevated, with several convex whorls, generally smooth; the last often large and ventricose; aperture entire, transverse, oblique, lunate, or semi-ovate, impressed by the prominent part of the body whorl, and sometimes furnished with one or more lamelliform teeth; peristome confluent with the columella, generally thickened internally, or having the edge reflected, especially on the side covering the umbilicus; without an operculum.

Notwithstanding that in Lamarck's time but little was known of the comparative anatomy of the animals belonging to this family, we must concur in the regret expressed by M. Deshayes (2d edit., 'Hist. Nat.' &c.) that that illustrious naturalist did not attempt a systematic arrangement of the numerous species forming this genus.

A much more intimate knowledge of the anatomy of the animals has since been acquired; and it appears that, although the shells present a great variety of forms, differences of organisation of importance sufficient to justify the separation of genera to receive them, do not exist, or, at all events, have not been observed in the animals. This strong general resemblance extends, in fact, to the whole of the

Helicidæ, and induced M. de Férussac to arrange the different genera as sub-genera merely of the typical genus *Helix*.

The present genus, as defined by Lamarck, embraces considerably more than a thousand living species; and may well be considered to be "deserving of subdivision, were it only to assist the student in the difficult task of investigation." Very many genera and sub-genera (amounting, including the synonyms, to nearly two hundred,) have, in fact, been proposed from time to time by different authors; but being nearly all founded, more or less, on conchological differences, they are, with few exceptions, rejected by the advocates of a strictly natural arrangement. M. Deshayes, one of the most able advocates for a system of arrangement dependent on anatomical structure, admits the convenience of having recourse to artificial divisions in this genus in which it is impossible to form natural groups; and suggests that the *Helices* may be classed, by the form of the shell, in four sections, consisting of the planorbular species, (*Zonites*, Montfort; *Helicella*, Lamarck,) the globose species, (*Acavus*, Montfort,) the carinated species, (*Iberus*, Montfort; *Carocolla*, Lamarck,) and the trochiform or turbiniform species (*Petasia*, Beck; *Geotrochus*, Swain.): and that these sections may be again subdivided into groups, according as the species are or are not umbilicated, have the aperture simple or reflected, or are or are not furnished with teeth.

The fossil *Helices* are more numerous than might be expected with respect to land-shells. Many extinct species, from the Freshwater deposits of the Paris basin, have been described by MM. Brogniart, ('Ann. du Mus.' vol. xv, p. 378,) Deshayes, ('Descr. des Coq. Foss.,' &c., vol. ii,) Matheron, ('Ann. des Sci. et de l'Indust. du Midi,' vol. iii,) Michaud, ('Guerin's Mag. de Zool.,' 1837,) De Roissy, ('Guerin's Mag. de Zool.,' 1839,) and Melleville, ('Mém. sur les Sables Tert. Inferieurs du Bassin de Paris,' p. 45;) and from the contemporaneous Freshwater formations in Germany by MM. Zeiten, ('Petr. Wurt.,' tab. xxix and xxxi,) Steininger, ('Bull. Soc. Géol. de France,' vol. vi,) Deshayes, ('Ency. Méthod. Vers.,) and Pusch, ('Polens. Pal.,' p. 94.) One species only, *H. globosa*, has as yet been described from the synchronous deposits in England; to this I am enabled to add eight species, one of which is identical with an existing species, *H. labyrinthica*, Say., found in North America.

Many species also occur, mixed with marine remains in the Miocene formations of Touraine, Dax, and Bordeaux, and in the Pleiocene formations of Piedmont, the Crag of England, and its equivalent in Belgium; of these but few are extinct, by far the greater number being referred to existing species.

Among the French species described by M. Deshayes is one (*H. dubia*), which, on the authority of Mr. Underwood, is mentioned as occurring in the Isle of Wight. I have not met with any specimen from that place; and M. Deshayes, as I learn from that gentleman himself, entertaining doubts as to the English locality, I have not considered *H. dubia* as an English species.

No. 14. *HELIX VECTIENSIS*. *F. E. Edwards*. Tab. X, fig. 8 *a—e*.

H. testá orbiculato-depressá, umbilicatá; superficie punctulis minutissimis confertis aspersá; spirá parum elevatá; anfractibus quinque sub-rotundatis, suturis depressis; aperturá semi-ovali, peristomate reflexo: umbilico profundo, semi-obtecto.

A somewhat convex shell, having the surface thickly covered with minute punctules. The slightly elevated spire is composed of about five bluntly convex whorls, depressed at the sutures. The aperture is semi-ovate, having the margins strongly reflected; that of the inner lip partly covering the umbilicus, which is deep and moderately wide. The shells, when in the young state, are, like many others in this genus, slightly carinated. In the general contour, this species much resembles the recent *H. rufescens*, but it is distinguished as well by the punctulated surface, as by the less rounded whorls, the more strongly reflected peristome, and the larger umbilicus.

Casts in the Limnæan limestone at Sconce are not uncommon; but specimens with the shell preserved are rare. The casts may be separated from those of *H. D'Urbani*, with which, at first sight, they are liable to be confounded, by the narrower umbilicus, and frequently by the impression of the reflected lip of this species. Where the shell is preserved, the punctulated surface presents a character by which it may be at once distinguished.

Diameter, 4-10ths of an inch; elevation, 2-10ths in.

Localities.—Sconce near Little Yarmouth, and Headon-Hill, Isle of Wight.

No. 15. *HELIX D'URBANI*. *F. E. Edwards*. Tab. X, fig. 5 *a—d*.

H. testá orbiculato-depressá, lævi, umbilicatá: spirá subprominulá; anfractibus quinque aut sex sub-rotundatis; suturis perspicuis: aperturá semi-ovali, peristomate simplici; umbilico magno.

A smooth, depressed, umbilicated shell, with a slightly elevated spire; the five or six volutions of which it is composed are bluntly convex, and the upper edges are so much depressed as almost to present a channel at the suture; the aperture is semi-ovate, with a perfectly simple unreflected lip; the umbilicus is wide, disclosing the volutions within.

This species somewhat resembles *H. Lemani* of Brogniart, but the spire is less elevated, and the umbilicus is more open.

The smooth and polished surface, which barely shows the lines of growth, and the sharp lip prevent its being confounded with *H. Vectiensis*. When young, the whorls are slightly carinated. A variety occurs in which the spire is much depressed, and the whorls consequently assume a less bluntly convex form.

The species is not uncommon ; but most generally casts only are found. In that condition the wide umbilicus is the only character by which it can be separated from *H. Vectiensis*.

Diameter, 4-10ths of an inch nearly; elevation rather more than 2-10ths in.

Localities.—Sconce and Headon-Hill.

I have much pleasure in dedicating this species to my friend John D'Urban, Esq., whose Palæontological pursuits have enabled him to add several interesting species to our Eocene Fauna.

No. 16. *HELIX GLOBOSA*. Sowerby. Tab. X, fig. 2 *a—d*.

H. GLOBOSUS. Sow. 1818. Min. Con., vol. ii, p. 157, t. 170.

— Morris. 1843. Cat. of Brit. Fos., p. 147.

H. testâ globoso-conoideâ, apice obtuso: anfractibus sex aut septem, transversim substriatis, ultimo anfractu ad basin convexo; striis numerosis, irregularibus, tenuissimis; suturis perspicuis; aperturâ depressâ, semi-lunari, marginibus reflexis; columellâ sub-rectâ; umbilico oblecto.

This well known shell is globosely conical, with an obtuse apex; the spire is formed of six or seven whorls, which exhibit obscure, transverse, irregular striæ, or lines of growth, so faint that, as Mr. Sowerby remarks, they are only to be seen in the best preserved specimens. The base of the shell is very tumid, rising from the periphery of the whorl with a bluntly convex swell until it nearly reaches the umbilicus, into which it sinks abruptly, imparting an almost vertical slope to the columella. The aperture in the adult shell is semilunate and depressed, with the margins reflected, that of the inner lip entirely concealing the umbilicus. The young shell, like that of all the globosely conical shells of this genus, presents a form very different from that of the mature one. When in the young state, the whorls are subcarinated, increase rapidly in size, and consequently are very convex, giving a sub-quadrate form to the aperture; and the shell presents a small umbilicus: but, as the shell approaches maturity, they lose their sub-carinated form, increase in size more and more slowly, and become less and less convex in their contour, so that, in the mature state, the aperture assumes a semilunate form, and at this period of growth the umbilicus is concealed by the reflected margin.

Specimens with the shell preserved are extremely rare, but casts in all stages of growth are comparatively common at Sconce Point. In the young state the casts resemble those of *Helix oclusa*; but the flattened base, the shorter and more oblique columella, and the semi-ovate aperture, serve to distinguish the latter species.

I am indebted to Mr. Sowerby for the use of the original specimen described

in the 'Mineral Conchology,' from which the larger figures are taken; fig. 2 *a* is from a specimen in the cabinet of Mr. D'Urban.

Diameter, 2 inches; elevation, 2·3 in.

Localities.—Shalcome (near Ryde) and Sconce, Isle of Wight.

No. 17. *HELIX OCCLUSA*. *F. E. Edwards*. Tab. X, fig. 10 *a—e*,

H. testá sub-globosá, fulvo uni-fasciatá; spirá prominulá, quinquies vel sexies circumvolutá; anfractibus convexiusculis, ad suturam depressis, obscure ad basin striatis, subplanulatis; aperturá semi-ovatá, marginibus parum reflexis: margine columellari umbilicum occludenti.

A sub-globose shell, with a somewhat elevated spire, composed of five or six rapidly enlarging convex whorls, depressed round the suture, and flattened on the base. The surface presents numerous, very faint, oblique, irregular striæ, produced by the lines of growth. The aperture is of a regular semi-ovate form, having the margins slightly reflected; the inner lip spreads over, and entirely closes the umbilicus. The shell is ornamented by a narrow, brownish-yellow band running round the whorls, just above the line of the suture, the colouring matter of which is retained, more or less, in all the specimens I have seen, in which the shell is preserved.

This is a well-marked species, easily distinguishable when the shell is preserved. The casts, which are more commonly found, resemble those of the young shell of *H. globosa*, but can be separated from them without difficulty by the flattened base and oblique columella which present a strong contrast with the tumid base, and nearly vertical columella of that species. The smaller number of the whorls and the narrower umbilicus separate it as distinctly from *H. Vectiensis* and *H. D'Urbani*.

Diameter, 1·2 in.; elevation, $\frac{3}{4}$ in., nearly.

Localities.—Sconce and Headon Hill, where it occurs more rarely than any of the preceding species.

No. 18. *HELIX TROPIFERA*. *F. E. Edwards*. Tab. X, fig. 3 *a—c*.

H. testá orbiculari, supra plano-convexá, subtús convexo-turgidá, umbilicatá: spirá plus, minusve elevatá; anfractibus quinque aut sex, ad peripheriam subcompressis, et carinatis; aperturá transversá, subtrigoná; marginibus reflexis umbilico magno.

I have seen two specimens only, both casts, of this *Helix*; from the character of the whorls and the aperture it would belong to Lamarck's genus *Carocolla*,—the *Chilotrema* of Dr. Leach. It is an orbicular shell, with a slightly elevated spire, apparently variable in height; the upper sides of the five or six whorls, of which it is formed, are nearly flat, and somewhat compressed near the periphery, which presents a

sharp keel; the under side is tumidly convex, rising with a regular swell until it approaches the umbilicus, into which it sinks rather suddenly, presenting a blunt angle which defines the umbilicus. In the smaller of the two specimens, the spire is more elevated, and the underside of the body-whorl more convex than in the other. The umbilicus is deep and moderately wide; the aperture transverse, and wider than long. The specimen figured exhibits the impression of a slightly reflected peristome.

The present species is much less than the recent *H. lapicida*, the umbilicus is smaller in proportion, the keel round the whorls more prominent, and, judging from the cast figured, which appears to be that of a fully-grown shell, the aperture at maturity does not present the downward inflection which characterises *H. lapicida*. The condition of the keel is apparently a character of little value, inasmuch as it varies considerably in specimens of *H. lapicida*, some of which, particularly in the young state, have it as acute and prominent as that of the present shell.

The smaller size of the umbilicus, and the absence of the downward inflection of the aperture, are the most important differences; but these characters, even if constant, would scarcely justify my considering the shell as more than a variety. With only two specimens, however, and those casts, I do not venture to pronounce as to their identity with the recent species. If, on more perfect specimens being obtained, it should appear that the shell presents the granulated surface which characterises *H. lapicida*, I should feel little hesitation in referring it to that species.

The specimen figured belongs to Mr. D'Urban's collection.

Size.—Diameter, $\frac{1}{2}$ an inch; elevation rather more than 2-10ths in.

Locality.—Headon Hill, where, however, it is extremely rare.

No. 19. *HELIX OMPHALUS*. *F. E. Edwards*. Tab. X, fig. 5 *a—c*.

HELIX STRIATELLA. *S. Wood*. Lond. Geol. Journ., vol. i, p. 118.

H. testâ planorbulari, depressâ, undato-costulato-lineatâ, umbilicatâ: anfractibus quaternis, convexiusculis; suturis conspicuis, depressis: aperturâ rotundato-semi-lunari: marginibus simplicibus; umbilico magno.

This shell, which belongs to the section represented by *Zonites*, Montfort,*

* The genus *Zonites*, as defined by Mr. Gray, embraces those *Helices* which have a depressed spire and a lunate mouth, with thin simple lips. It is divided into two sections—*Verticillatæ* (Fér.), in which the shell is brown, or varied, and striated; and *Hyalinæ* (Fér.), in which the shell is hyaline, greenish or pale brown, and polished. It appears, from the observations of Mr. W. Thompson, to which I have before referred, that, judging from the characters afforded by the dentition, the animal of *Z. radiatus* (one of the *Verticillatæ*) is a true *Helix*; but that in four species of the *Hyalinæ* examined by him, the animals would form a connecting link between *Vitrina* and the true *Helices*. Professor E. Forbes and Mr. Hanley, in their 'History of British Mollusca,' restrict the genus to the Hyaline species.

(*Helicella*, Lamarck,) is somewhat discoidal, with a slightly elevated spire formed of about four whorls, generally rounded or bluntly convex, but which, in two casts of fully grown individuals in my cabinet, present a sub-carinated periphery. The surface is covered with numerous regular raised lines, separated by shallow rounded sulci; the lines are oblique, undulating, and rounded. The margins of the depressed semilunar aperture are simple and unreflected. The umbilicus is moderately wide.

Mr. S. Wood, in his 'List of Shells from Hordwell Freshwater Bed,' has referred this shell to the North American species, *H. striatella*, Anthony; but, although I feel great hesitation in dissenting from his opinion, the differences between the two render it difficult to maintain their identity, at all events, before we are better acquainted with the influence of external conditions in modifying the forms of the animal and its shell. I should add that I have only one specimen with the shell preserved, (the one referred to by Mr. Wood, and which he has been kind enough to add to my collection,) and that this specimen is in an imperfect state. On comparing this shell with the recent *H. striatella*, it will be seen that in the latter species the spire is more elevated, the lineation sharper, the sulci not so deep, the whorls wider, rounder, and less embracing; the suture not so depressed, and the aperture larger. Similar differences exist between this and *H. ruderata*, a species from Cincinnati described by Binney. In *H. perspectiva*, Say, which it somewhat resembles, the spire is more depressed, the lineation, like that of *H. striatella*, is fainter and sharper, the volutions more numerous, the peritreme more distinctly carinated, and the umbilicus wider.*

A shell occurs in the Pleistocene freshwater deposit at Clacton, which is referred to *H. ruderata*: the striation resembles that of the present shell; but in other respects it very closely resembles the American shell. M. Deshayes has described a fossil shell from the upper freshwater formation of the Soissonnais (*H. Ferrantii*), to which this species presents a general resemblance; but it is separated from that shell by the more elevated spire, and the more numerous whorls; and in *H. Ferrantii* the raised lines appear to be fewer and less regular, and the umbilicus to be narrower.

Size.—Diameter $\frac{1}{4}$ of an inch, nearly; elevation 1-10th inch.

Localities.—Hordwell Cliff; Sconce.

* The *H. striatella* of Anthony is from Massachusetts, and, until recently, was considered to be merely a variety of Say's *H. perspectiva*, which is from Ohio and Lake Erie. Gould, in his 'Report on the invertebrate Animals of Massachusetts,' has pointed out the distinctions. The *H. ruderata* of Binney is from Cincinnati, and has also been considered as a variety of *H. perspectiva*; it appears to belong rather to *H. striatella*.

No. 20. *HELIX LABYRINTHICA*. Say. Tab. X, fig. 7 *a—e*.

<i>HELIX LABYRINTHICA</i> .	Say. Journ. Acad. Nat. Sc. Philadelphia, vol. 1, p. 124.
— —	Nicholson's Encycl. (Amer. Edit.), 4.
— —	Férussac. Hist. Natur. des Moll., tab. li B, fig. 1; Prodromus, No. iii.
— —	Binney. Boston Journal Nat. Hist., vol. iii, tab. xxiv, fig. 1.
— —	Gould's Report of the Inverteb. of Massachus., p. 184.
— LABYRINTHICUS.	S. Wood. Lond. Geol. Journ., vol. i, p. 118.

H. testâ minimâ, globoso-conicâ, transversim lineatâ, umbilicatâ; lineis obliquis, undosis, numerosis; spirâ plus minusve elevatâ, series circumvolutâ; anfractibus convexis ad basin sub-planulatis: aperturâ depresso-semilunari, peristomate reflexo: margine columellari uno dente lamelliformi instructo: umbilico magno, profundo.

This pretty and very rare *Helix* is a small, roundedly-conical shell, with a more or less elevated spire, composed of about six gradually increasing whorls, separated by a clearly defined suture, and ornamented with numerous, elevated, obliquely transverse, equidistant, raised lines, more or less prominent in different individuals. These lines are somewhat acute, slightly undulated, and, running into the umbilicus, cover the whole surface of the whorls. The base of the shell is but slightly convex; the aperture of a depressed semilunar shape, with the peristome reflected. The columella lip presents a large lamelliform tooth, prolonged within the aperture, and running parallel with the suture. The umbilicus is deep and wide, being about one third of the diameter. In one specimen in my cabinet, the spire is very much depressed, almost planorbular, and the apex more obtuse.

This species derives additional interest from the fact that, having survived through the inconceivably long spaces of time required for the deposit of the Miocene and the more recent formations, and having become extinct in the hemisphere in which it first appeared, it is now found among the living forms of North America. The recent *Helix labyrinthica*, first described by Say, is spread over a wide range of country, extending from Ohio to Florida, and from Missouri to Texas. Specimens from Texas, Ohio, and Florida are preserved in the British Museum; and, after a careful comparison with them of the fossil shells, it appears to me that differences of sufficient importance for specific distinction cannot be detected between them; I therefore fully concur with Mr. S. Wood in the opinion expressed by him of their specific identity, and I do not hesitate to refer the fossil shell to Say's species.

In order to facilitate an examination into this identity, it will be useful to give Say's description in his own words. It is as follows: "Shell conic, dark reddish-brown; body lighter; whorls five or six, with conspicuous, elevated, equidistant, obtuse lines across, forming grooves between them; apex obtuse; lip reflected,

rounded; pillar-lip with a large, lamelliform, elongated tooth, which appears to revolve within the shell parallel to the suture; a smaller raised line revolves nearer to the columella within the shell, but becomes obsolete before it arrives at the pillar-lip. Umbilicus large. Breadth 1-10th of an inch."

Taking the Texas shells, the form described by Say as the typical form of the American species, the fossil shell presents, on comparison, the following variations:

1st. The shell is somewhat smaller; the spire, except in the specimen I have noticed, is more elevated, the apex not so obtuse, and the whorls are less convex.

2d. The base of the shell is flatter, and the aperture not so rounded.

3d. The position of the larger raised line is more median, and the smaller raised line is wanting; and,—

4th. The peristome is simply reflected, and not "rounded" or thickened.

Now it will be seen that the differences firstly mentioned are such as frequently occur in a series of individuals of the same species. The variable height of the spire, evidenced in the fossil shells by the depressed form of the specimen before mentioned, is a character also found in the recent species; since Gould, in his work above cited, states expressly that "the shell varies considerably in the elevation of the spire, being sometimes much flattened, and again it has a pointed apex;" an observation, the accuracy of which the Florida specimens in the British Museum fully confirm; and this difference in the elevation of the spire will depend on, and in fact will denote, the less or greater convexity of the whorls.

With respect to the flatter base, and the consequently less rounded aperture, the same specimens from Florida exhibit a similar departure from the type; in one instance, indeed, the base is so much flattened as to impart a sub-carinated form to the basal periphery of the whorl.

The position of the larger tooth is equally variable in the Texas specimens; and, as regards the absence of the second or smaller raised line, Gould says that, "usually but one of them (*i. e.* of the raised lines) exists;" a statement, in fact, borne out by some of the specimens from Ohio in the British Museum, in which the second line is not perceptible.

It is evident, then, that these variations, occurring as they do in the recent shells, cannot afford sufficient grounds for a specific distinction of the fossil shell; and the only difference which apparently does not elude us on comparison, is the thickened or, as Say describes it, the rounded outer lip of the recent shells. To rest specific distinction on this character, one which, in general, is only an attribute of maturity, and which, even if constant, could, at the utmost, merely serve to designate a variety, would be an excess of refinement. But it cannot be affirmed that this variation is constant, and a larger series of the fossil shells may show that even the thickened outer lip is not wanting. Of the influence of varied conditions in modifying the form of shells, very little is known or even conjectured; but we may reasonably believe that

a change in the ordinary conditions of temperature, and of the nature and supply of food, will be attended with appreciable differences in the development, although not in the organisation, of the animal; and that these differences will be represented in, and will modify the form of the shell. And to such a cause, perhaps, may be attributable the distinction, trivial as it is, which, as we have seen, exists between the shell of the living *H. labyrinthica* and those of its Eocene representatives.

The identity in question exhibits an instance of a terrestrial species surviving important geological changes, and prolonging its existence through geological epochs of very great extent, but to the probable duration of which no approximation even can be made and yet preserving its normal form almost without modification; an instance unparalleled, if, as will probably prove to be the case, the various forms of *Terebratula* referred to the recent *T. caput-serpentis* belong to different species.

Brogniart, ('Ann. du Muséum d'Histoire Naturelle,' tom. xv, p. 380,) has described a small trochiform *Helix* from the neighbourhood of Mans (*H. Menardi*), which, in the general character of its lineation, resembles this species. It is, however, larger; and the whorls, although described as being "nearly equal," appear, from the figure given, to enlarge more rapidly. The aperture is neither described nor represented, and it is impossible, therefore, to form any opinion as to the identity of the shell with the present species.

Size.—Diameter, 1-10th in.; elevation 1-10th in.

Localities.—Hordwell Cliff; Headon Hill.

No. 21. *HELIX SUB-LABYRINTHICA*. *F. E. Edwards*. Tab. XI, fig. 4 *a—c*.

H. testá minimá, globoso-conicá, umbilicatá; spirá elevatá, apice obtuso: anfractibus sex, rotundato-convexis, gradatim majoribus, transversim lineatis: aperturá, obliqua, semilunari, simplici (?) ; umbilico parvo.

I possess only one specimen, and that merely a cast, of this small and very rare *Helix*. Although more pupiform than *H. labyrinthica*, it approaches so nearly to that shell that I feel great hesitation in referring it to a distinct species; on examination, however, differences appear which scarcely justify my describing the shell as merely a variety.

It is a small, globosely conical shell, with an obtuse apex, and formed of six roundedly convex whorls, increasing in size very slowly. The impression of the whorls in the matrix presents a faint lineation, too regular to be due to lines of growth merely. The aperture is oblique and semilunar, but is too imperfect to enable me to say whether the peristome was or was not thickened or reflected. On the outer lip of the penultimate whorl are two linear impressions similar to those produced by lamelliform teeth, to the presence of which they may, perhaps, be attributed; but

they are not continued towards, and do not appear at, the aperture. The columellar lip does not present any evidence of teeth. The umbilicus is rather small.

On comparing this shell with *H. labyrinthica*, the distinctions appear to be that, in the present species, the apex is more obtuse, approaching, in that character, more nearly to the recent specimens of that species; the whorls enlarge more slowly, are more roundedly convex, and but slightly, if at all, flattened on the base; the aperture, partaking of the character of the whorls, is rounder, and the teeth, if present, are on the outer lip, and not on the columellar lip, as in *H. labyrinthica*; the umbilicus is smaller, and, if the shell were preserved, would, I think, be nearly closed.

Having only seen the single specimen in my collection, I propose the species with hesitation, although the characters seem to me sufficient for specific distinction.

Size.—Elevation 1-10th in. nearly; diameter 1-10th in., nearly.

Locality.—Headon Hill.

NO. 22. *HELIX HEADONENSIS*. *F. E. Edwards*. Tab. XI, fig. 5 a—d.

H. testá minutá, orbiculari, sub-depressá, umbilicatá; spirá prominulá; anfractibus sex, rotundatis, suturis perspicuis: aperturá rotundato-semi-lunari, obliquá; peristomate inerasato, reflexo; margine externo tribus lamellis, penitissime decurrentibus, instructo: umbilico lato, profundo.

A very small depressedly orbicular shell, with a somewhat elevated spire, composed of six or seven rounded whorls, separated by a deep suture; the rounded aperture is oblique, and impinged upon by the body whorl, which gives to it a semi-lunar shape; the peristome is slightly thickened internally, and reflected; and the outer lip is furnished with three lamelliform teeth, extending far back into the whorls; the umbilicus is wide and deep.

The *H. Headonensis* is apparently extremely rare; my specimen, which I believe to be unique, is merely a cast, and the outward condition of the shell is not shown. The species presents some analogy with the depressed variety of *H. labyrinthica*; but the greater number of the whorls, and the different dentition of the aperture, distinguish it from that shell. In general appearance it resembles the recent *H. pulchella*; but the spire is more elevated, the whorls more numerous, and, in the latter species, the aperture is without the plaits which characterise the present shell. The species appears to be well marked and perfectly distinct.

Size.—Elevation rather more than 1-20th in.; diameter 1-10th in.

Locality.—Headon Hill.

Genus 7th. BULIMUS.* *Scopoli*, 1786.BULIMUS, *Brug.*, 1792; *Lam.*, 1801.COCHLEA, *Adanson*, 1757.COCHLOSTYLA, *Férussac*.

Gen. Char.—Shell oval, oblong, or turriculated, smooth, or longitudinally striated; spire obtuse, variable in length and in the number of the whorls, which are generally few, and for the most part sinistral; aperture entire, oval, rounded anteriorly; outer lip simple, generally reflected and confluent with the columella; inner lip reflected over the body whorl; columella smooth.

This genus, originally proposed by Scopoli, was adopted by Bruguière, and extended so as to comprise animals essentially different in their organisation; many genera have, in consequence, been since separated from it by Draparnaud, Lamarek, and others. The animal closely resembles that of *Helix*; but M. Deshayes states that it presents a modification of the organs of generation sufficient for generic distinction. The shells may be known from the *Helices* by their more elongated spiral form; from the *Limnææ* by the smooth columella, and from *Pupa* by the more regularly tapering spire.

The genus contains very many living species distributed over the equatorial, tropical, and warm temperate regions, as well of the new, as of the old, world. According to Mr. Lovell Reeve† the localities of nearly 600 species have been ascertained; and of these, three fifths inhabit the western hemisphere, principally central America; and a large proportion, rather more than one third, of the remaining species is found in the Phillippine Islands.

Several fossil species, from the Freshwater deposits of the Paris Basin, have been described by MM. Brard, Brogniart, Lamarek, Defrance, Matheron, and Deshayes; and two distinct species (*B. ellipticus*, Sow., and *B. politus*, nov. spec.,) occur in the

* The etymology of this word is not ascertained. Adanson in 1757, in his 'Histoire Naturelle du Sénégal,' applied the name *Bulinus* to a species of the shells which afterwards formed part of Draparnaud's genus *Physa*, but which have since been separated by Dr. Leach, under the generic name *Aplexus*; and the writer of the article "Limnæans," in the 'Penny Cyclopædia,' suggests, and apparently with much probability, that the word *Bulimus* was used by mistake by Scopoli and Bruguière for *Bulinus*. Studer seems to consider *Bulimus* to have been intentionally substituted for *Bulinus*, and says that the alteration is altogether inadmissible; and Hartmann and Mr. Broderip concur in rejecting the name. Herrmannsen fancifully derives the word from *βουλιμος*, *ingens fames*, in allusion, I presume, to the voracity of the animal. The name *Bulimus*, however, whatever may be its origin or meaning, appears to be generally adopted, and I have therefore retained it.

† Mr. Lovell Reeve, "On the Geographical Distribution of the Bulimi," &c., 'Ann. and Mag. of Nat. Hist.,' 2d ser., vol. vii, p. 241.

contemporaneous deposits in England. The shell described by Mr. Sowerby ('Min. Con.,' vol. iv, p. 89 bis, t. 366), as *B. costellatus*, is an Achatina. Two of the French Eocene species have been found, mixed with marine remains, in the Faluns of Touraine; but, as yet, no species has been found below the Eocene formations.

No. 23. BULIMUS ELLIPTICUS. *Sowerby. Tab. XI, fig. 2 a—f.*

BULIMUS ELLIPTICUS. *Sowerby. 1822. Min. Con., vol. iv, p. 46, t. 337.*

— **TENUISTRIATUS.** *G. Sowerby, jun., 1846. Lond. Geol. Journal, vol. i, p. 20.*

B. testá sinistrorsá, ovali, elongatá; apice obtuso: anfractibus plano-convexis, superné sub-candiculatis; transversim lineatis; lineis obliquis, irregularibus, plus minus-ve numerosis; aperturá sub-auriformi, peristomate simplici, margine columellari reflexo.

A sinistral, cylindrically-conical shell, with an apex more or less obtuse in different individuals; the whorls are slightly convex, depressed at the upper margin so as to form an obscure channel running parallel with the suture, and covered with numerous transverse raised lines, which are rounded, oblique, and vary considerably in number, frequently in the same specimen. The aperture is oblong and ovate; the sharp outer margin is slightly reflected where it joins the columella, and is frequently thickened as it spreads over the body-whorl.

Fig. 2*f* is taken from a specimen belonging to Mr. Wetherell, found in the excavations in the London Clay at Primrose Hill for the London and Birmingham Railway. The lineation of this fragment is fainter and more crowded, and the whorls appear to be more angular at the base than in *B. ellipticus*; these distinctions induced Mr. G. Sowerby to refer the shell to a distinct species. The faintness of the transverse lines is, however, due to the worn state of the shell, which has apparently lost the outer layer; and their number is a character too uncertain to be relied upon. The specimen represented by fig. 2*a*, from Mr. D'Urban's collection, shows on one side of the penultimate whorl, lines nearly as crowded as those on the Highgate specimen, while those on the opposite side of the same whorl are moderately distant; and I have in my own collection a specimen, beautifully preserved, in which the same discrepancy occurs. The angularity of the whorls is a character frequently found in shells in an early stage of their growth, and I have several young shells of this species, in which the whorls present a clearly defined angle running round the basal periphery. On these grounds I have referred the specimen in question to the present species.

A form occurs at Binsted, near Ryde, in which the whorls are flatter than in ordinary specimens, and sub-turritid; in other respects it agrees with this shell, of which, therefore, I consider it to be only a variety.

Size.—The specimens ordinarily found rarely exceed $2\frac{1}{2}$ inches in length by 9-10ths of an inch in diameter; one specimen, however, in my collection is above 3 inches long, and rather more than 1 inch and 2-10ths in diameter; and the shell from which fig. 2c is taken, forming part of the valuable collection of the late Mr. Dixon now in the British Museum, must have exceeded even those dimensions.

Localities.—Shalcombe, Binstead, Sconce, in the Isle of Wight.

No. 24. BULIMUS POLITUS.

. Tab. XI, fig. 1 a—d.

B. testá conicá, lævissimá, politá; apice deciduo; anfractibus sub-concavis; apertura ob-ovali, anticé effusá, postice sub-angulatá, peristomate incrassato, reflexo.

The occurrence of this shell in the fluvio-marine deposit in Headon Hill in such abundance as almost to be inconsistent with the supposition that it is a land shell, suggests that it might be placed with those Paludinæ, in which the margins of the aperture are thickened or reflected, and of which an instance (*Paludina Chastellii*, Nyst,) occurs in a similar formation in Hampstead Cliff. The aperture, however, and the smoothness of the surface, place it, perhaps, more correctly in the present genus, although the latter character is frequently shown in well-preserved specimens of *Paludina* found in a somewhat similar matrix.

The shell is conical, with a smooth polished surface, on which faint lines of growth are barely perceptible; the apex is subject to decollation, leaving about four convex whorls; the last of which, somewhat like that of *Nematura*, is slightly contracted near the aperture, which is rounded and very effuse in front, and angulated behind; the peristome is thickened and reflected. The length of the aperture is about 2-5ths of that of the whole shell.

The specific name is one by which the shell is generally known. I do not know by whom it was imposed, but it well describes the smooth and polished appearance of the shell, and I have therefore retained it.

Size.—Elevation 2-10ths of an inch; Diameter 1-10th in.

Locality.—Headon Hill.

Genus 8th. ACHATINA.* *Lamarek.*

COCHLITOMA, *Férussac.*

Gen. Char.—Shell oval or oblong, subturreted, with an elevated spire; generally smooth, but sometimes longitudinally striated: aperture oval or pyriform, generally greater in length than in width; outer lip thin, never thickened or reflected; columella

* Etym., Diminutive of *Ἀγαθος*, beautiful; or of *Ἀγάτης*, an agate.

smooth, inflected and truncated at its base, forming a slight notch where it joins the outer lip.

The third division made by Bruguière in his genus *Bulimus*, consisting of those species in which the columella is truncated at the base, was formed by Lamarck into the present genus. From this Montfort withdrew his genera *Liguus*, (*Chersina*, Humph.) consisting of the conical forms in which the aperture is short and nearly round; and *Polyphemus*, comprising the oblong sub-turreted species, with an undulating outer lip, to which Bolten had already given the name *Oleacina*, and which forms the genus *Glandina* of Schumacher and Say, and the sub-genus *Cochlicopa* of Férussac.

As some of the Bulimi present a sharp outer lip, the truncation of the columella appears to be the only character by which the Achatinæ can be separated from that genus, and the value of this character must depend on its being the result of some peculiarity of generic importance in the organisation of the animal. M. De Blainville states that he has observed in the animal of *Achatina zebra* an interruption in the collar where the two sides unite, as if caused by the exertion (saillie) of the columellar muscle, and to this he attributes the truncation of the columella; but, according to Férussac, this truncation is not the result of any peculiar organisation, as is the case in other molluscous animals, the columella of whose shells present this character; and that author therefore unites the Achatinæ to his genus *Helix*, of which they form the sub-genus *Cochlitoma*; and M. Deshayes, on account of the similarity of organisation presented by the animals of *Bulimus* and *Achatina*, proposes to re-unite *Achatina* with *Bulimus*. The genus, however, is very generally adopted as well by English as by foreign Malacologists, and I have therefore retained it.

The subdivisions proposed by Bolten and Montfort depend on the proportions and other characters in the shell, of trifling importance, which are generally considered as insufficient for generic distinction, however useful they may be for the division of a genus into sections. The recent species *A. glans*, and the cognate species which form the genus *Glandina*, are confined to the West Indian Islands, and the adjacent parts of the American Continent; and the peculiar form of the outer lip may be used with convenience, as one of the indications of the limits of geographical distribution of species.

The Achatinæ are generally large shells; some, in fact, attain a greater size than any other land shells at present known, and many are covered with an epidermis. Although generally dextral, they are in some species constantly sinistral. They are found chiefly in tropical climates, and, according to Blainville, in marshy lands. Some few are European, but only one or two small species occur in England. One fossil species (*A. pellucida*) has been described by M. Deshayes from Parnes; and Bouillett, in his catalogue of the fossil shells of Auvergne, has given another species, which he refers to the recent *A. acicula* (Lamarck).

No. 25. *ACHATINA COSTELLATA*. Sowerby. Tab. XII, fig. 1 *a—k*.

BULIMUS COSTELLATUS. Sow. Min. Con., vol. iv, p. 89 bis, t. 336.

LIMNEA MAXIMA. Sow. Ib., vol. vi, p. 53, t. 528, fig. 1.

BULIMUS COSTELLATUS. Morris. Cat. of Brit. Foss., p. 140.

LIMNÆUS MAXIMUS. Morris. Ib., p. 148.

A. testā ovato-oblongā, apice sub-acuto; anfractibus sex convexiusculis, longitudinaliter costellatis, ad suturam adpressis et irregulariter sub-crenulatis; costellis parum obliquis, irregularibus: aperturā pyriformi, dimidium totius testæ in longitudinem ferè æquanti, margine externo undato.

Var. ABBREVIATA. Fig. 1 *i—k*. *A. testā ventricosiori, breviori; anfractibus quinque, convexioribus; aperturā longiori, spiram in longitudinem superanti.*

Shell oval-oblong, with a somewhat acute apex; the six volutions, of which the spire is formed, are more or less convex in different individuals, and are longitudinally ribbed; the edges are slightly pressed against the preceding volution, so as to present a narrow band running round the spire, parallel with the suture; the ribs are rounded, irregular, rather oblique, and slightly thickened above the sutural band, giving a rough crenulated appearance to the edges of the volutions; they are crossed, saltierwise, by very faint obscure lines of growth, perceptible only in well-preserved specimens. The aperture is pear-shaped, and about half as long as the entire shell; the outer lip undulated. The truncation of the columella, a character which the imperfect state of the specimens figured by Mr. Sowerby did not enable him to detect, places the shells, described by that author as *Limnea maxima* and *Bulimus costellatus*, in the present genus. The volutions are variable, being in some specimens less convex than in others; and the aperture in the young state is comparatively longer than that of the mature shell. A similar change in the relative proportions of the spire and the aperture at different stages of growth is not of infrequent occurrence, and is exhibited in some of the recent species in this genus, particularly in *Achat. striata*, (*Glandina truncata*, Pfeiffer.) These considerations, confirmed by the examination of a long series of shells of the present species in different stages of growth, have induced me to consider *Bul. costellatus* as merely the young form of the shell figured as *Limnea maxima*. The more regularly conical form of the spire, the only distinction by which the former is separable from the latter, is mainly due to the preservation of the shell in the specimen figured, and is a character which cannot be relied upon.

The present species belongs to the group constituting the genus *Glandina*, and is another instance of the approximation of an European Eocene land Mollusc to the living forms of the Western world.

Size.—Axis $2\frac{1}{4}$ inches, nearly; diameter 9-10ths of an inch.

The specimen represented by figs. 1 *i* and 1 *k*, resembles the type in the crenulated

edges, and costellation of the volutions, in the shape of the aperture, and in the character of the columella; and I consider it, therefore, as merely a variety. It is a ventricose shell, with a shorter spire, and more convex whorls; the aperture is longer in proportion, exceeding the spire in length, owing probably to the shell not having attained maturity. The specimen, the only one I have seen, belongs to Mr. D'Urban's collection.

Size.—Axis 1 inch and 6-10ths; diameter, 1 inch, nearly.

Localities.—Sconce, Shalcombe, Binstead, Isle of Wight.

Genus 9th. PUPA.* *Lamarck*. 1801.

COCHLODONTA, (sp.), *Férussac*.

COCHLODINA, (sp.), *Férussac*.

COCHLOGENA, (sp.), *Férussac*.

Gen. Char.—Shell cylindrical, elongated, or sub-globose; apex generally obtuse, sometimes acuminate; whorls numerous, slowly increasing, the last smaller than the penultimate one; frequently striated or ribbed; aperture generally elliptical, sometimes sub-quadrate in front, and rounded behind; peritreme continuous, slightly incrassated and reflected; outer lip dentated; teeth variable in number; one or two plaits on the columella.

The present genus is one of the dismemberments effected by Lamarck of Bruguière's genus *Helix*. The organisation of the animal bears a strong general resemblance to that of the animals of *Helix* and *Bulimus*; and Férussac has reunited the genus to *Helix*, in which it is distributed among the sub-genera *Cochlodonta*, *Cochlodina*, and *Cochlogena*. The shell, however, prevents striking dissimilarities, and in the animal, according to M. Deshayes, the same modifications of the generative organs occur which distinguish the animal of *Bulimus*. The elongated cylindrical form of the spire, the proportion of the last whorl to the penultimate one, and the direction of the aperture which is parallel with the axis, distinguish the shell from *Helix*; and it is separated from *Bulimus* by the numerous and slowly increasing volutions, and by the teeth and folds with which the outer lip and the columella are furnished. It is to *Clausilia* that it bears the closest resemblance; but from that genus it is separated as well by the aperture as by the absence of the clausium, a character which, however, can seldom be available to the Palæontologist.

In the animals of several of the smaller species the peduncles only exist, the tentacles becoming obsolete. Some of these species are sinistral and hyaline, and form Müller's genus *Vertigo*. The animal, however, exactly resembles *Pupa* in everything but the absence of the tentacles, and, inasmuch as their disappearance is very gradual

* Etym., from a supposed resemblance to the Pupa or Chrysalis of some insects.

in the smaller species, M. Deshayes attributes but trifling value to that character, and proposes to suppress the genus altogether.

The living species are very numerous and widely disseminated, but the larger ones are confined apparently to tropical climates.

The fossil species are few; one species (*Pupa Defranci*) is described by Brogniart from the Freshwater deposits of the Paris basin. Bouillet, in his catalogue of the fossil shells of Auvergne, gives two others referred to recent species; and Matheron describes two more species from the South of France, one from the Freshwater formation at Baux, and the other from the middle beds of the lignite formation near Rognac.

NO. 26. PUPA PERDENTATA. *F. E. Edwards*. Tab. XI, fig. 7 a—e.

P. testá cylindricá; apice . . . ? anfractibus planulatis, longitudinaliter costellatis, ad basin sub-angulatis; costellis acutis, numerosis, irregularibus, undulosis, parum obliquis; aperturá sub-quadrátá, multis lamellis inequalibus, penitissimé decurrentibus, utroque margine instructá.

The imperfect state of my specimens, which are merely casts, will not enable me to do much more than to record the existence of this well-marked species. The dentition they present rather belongs to *Clausilia* than to *Pupa*; but as this is a dextral shell, and all the known *Clausilia* are sinistral, I refer it to the present genus. I possess six or seven specimens only, all without the apex, and the largest showing only the last three whorls. The characters, so far as they can be given from these fragments, are as follows:—Shell cylindrical, apparently elongated, and composed of many whorls; the whorls nearly straight, longitudinally costellated, and bluntly angulated at the base; the costellæ sharp, oblique, numerous, irregular, undulating, and separated by deep rounded sulci, and here and there one of them terminates abruptly, being cut short by the confluence of the sulci. The aperture, owing to the angular base of the body-whorl, assumes a subquadrate, or rather a lozenge shape; the outer lip presents no less than fourteen lamelliform teeth, six of which are large, having smaller teeth between them; the columellar lip is armed with three large lamelliform teeth, and four smaller. These teeth are not merely marginal, as is usually the case in this genus, but are continued, like those of *Clausilia*, far back into the whorls.

Size.—Axis . . . ? diameter, 2-10ths of an inch nearly.

Locality.—Sconce, where it is very rare.

No. 27. PUPA ORYZA. *F. E. Edwards.* Tab. XIV, fig. 3 *a—b.*

P. testá parvá, ovato-cylindraceá, ad utramque extremitatem equaliter attenuatá; apice sub-obtuso; anfractibus octonis, convexiusculis, longitudinaliter tenuissime costellatis; suturis profundis; aperturá ovato-oblongá, angustá, obliquá, quaternis dentibus magnis instructá.

A small cylindrical oval shell, tapering equally towards both extremities; the apex is rather blunt; the whorls, which are eight in number, are slightly convex, separated by a deep conspicuous suture, and transversely costellated; the costellæ are numerous, very slender, and oblique. The aperture is ovate-oblong, narrow, and somewhat oblique; the outer lip is furnished with four prominent lamelliform teeth, of which the two anterior are the longest.

I possess only one specimen, a cast, of this species; and the state of the aperture does not enable me to say whether the columellar lip is furnished with teeth. The species appears to be perfectly distinct.

Size.—Axis 2 lines; diameter 1 line.

Locality.—Headon Hill.

Genus 10th. CLAUSILIA.* *Draparnaud.* 1805.

Gen. Char.—Shell sinistral, cylindrical, elongated, consisting of numerous volutions, generally transversely striated; rather blunt at the apex, and enlarged towards the middle; aperture irregular, oval; peristome continuous, free, reflected, with several columellar and other tooth-like plaits, and furnished with an appendage, termed the *clausium*, attached to the columella, by which the aperture is partially closed when the animal is withdrawn into the shell.

The clausium, from which the present genus derives its name, answers the purpose of an operculum, with which, however, it presents no further analogy than that it serves to enclose and protect the animal within the shell. It consists of a narrow, flat, and very thin calcareous pedicle attached by the posterior extremity to the columella, and expanding at the opposite end into a linguiform plate, which nearly closes the aperture of the penultimate whorl, a small canal across the anterior part of the aperture being left uncovered, probably for the purpose of respiration. In some species when the outer lip presents teeth, the clausium is notched for their reception. This curious appendage is formed when the animal approaches maturity, probably at the same time with the projected reflected mouth. The pedicle is very flexible, and yields to the

* Etym. *Clausium*, (quasi *clausus*, closed, or *claustrum*, a door,) the appendage by means of which the animal is enclosed in the shell.

slightest pressure, as the animal emerges from the shell, and the clausium is then bent back against, and fits upon, the curved columella, but recovers its former position by the recoil of the pedicle on the removal of the pressure when the animal withdraws itself into the shell. This peculiar appendage was described first by D'Aubenton, and subsequently by Müller; and the group of shells characterised by its presence was formed by Draparnaud into the present genus.*

The animal of *Clausilia*, so far as its organisation is known, resembles that of Pupa, but Lamarek considered that the differences in the form and condition of the aperture to which I have already referred, were in themselves sufficient for generic distinction without reference to the presence of the clausium. On the other hand, Férussac has placed *Clausilia* in his genus *Helix*, where it forms part of his sub-genus *Cochlodina*; and M. Deshayes has been induced, by the resemblance between the external characters of the animals, by the similarity of their habits, and by the gradual passage from the one genus to the other by intermediate species, to propose the union of the two genera. Unless, however, peculiarity of structure or form in the shell is to be altogether disregarded, the presence of so singular an appendage as the *Clausium* must surely be considered as sufficient ground for the separation of this genus.

Nearly two hundred living species, mostly small shells, are known; several are found in this country, but they occur in great profusion in Southern Europe; the larger species belong to tropical climates.

Only three fossil species I believe have as yet been described; viz., *C. antiqua*, from the Freshwater limestone of Ulm; *C. maxima*, from the neighbourhood of Dax, and *C. campanica*, from the Freshwater limestone of Provins, in which the Paleotherian remains occur.

No. 28. *CLAUSILIA STRIATULA*. *F. E. Edwards*. Tab. XI, fig. 6 *a—h*.

Cl. testá subturritá, cylindracea, ad utramque extremitatem attenuatá, transversim lineatá: anfractibus numerosis, plano-convexis, ultimo ad basin porrecto; aperturá orato-pyriformi, obliquá; peristomate soluto, parum reflecto: lamellis quinque, duobus margine externo, tribus margine columellari, instructo.

A cylindrical, subturreted shell, attenuated at each extremity; the whorls are very slightly convex, and covered with numerous rather oblique raised lines, separated by broad rounded sulci, occasionally confluent; the last whorl detaches itself, and projects obliquely forward, terminating in an ovate, pyriform aperture, the margins of which are free, and a little reflected. The outer lip presents two unequal plait-like teeth, the smaller one near the middle, the larger one near the posterior angle of the

* A particular account of the Clausium has been given by Mr. Miller, in the 'Annals of Philosophy,' vol. iii, p. 378; and by Mr. J. E. Gray, in the 'Zoological Journal,' vol. i, p. 212.

aperture. On the columellar lip are three similar teeth, one, very large, close to the columella.

I have not been so fortunate as to meet with any specimen having more than fragments of the shell preserved; the description therefore is principally taken from casts. The chief characters presented by them, namely, the large pliciform teeth and the produced aperture, are, however, plainly shown. The specimen represented by figs. 6 *a* and 6 *b* is, I apprehend, the young shell.

Size.—My most perfect specimen of the mature shell has apparently lost the upper six or seven whorls; in its present state it presents six whorls only. The length of the axis is 6-10ths of an inch, nearly; the diameter 2-10ths, nearly. In a perfect state it was probably nearly an inch long.

Locality.—Sconce, where it is very rare.

Genus 11th. SUCCINEA.* *Draparnaud*. 1801.

AMPHIBULIMA, *Lamarek*, 1805; *Hartm.*, 1821.

AMPHIBULIMUS, *Montf.*, 1810.

COCHLOHYDRA, *Férus.*, 1819.

Gen. Char.—Shell ovate, or ovately conical, rather elongate; volutions few; spire short, pointed; aperture large, entire, longitudinally ovate, oblique; peristome sharp, not thickened nor reflected, and confluent with the columella; inner lip spread over a part of the body whorl; columella smooth, sharp-edged, with an imperforated axis.

This genus, first created by *Draparnaud*, has been received without question by all Malacologists except *Férussac*, with whom it forms the sub-genus *Cochlohydra* in his extensive genus *Helix*. The animals, like all others of this family, present a strong general resemblance to the typical *Helix*; but, according to *M. Deshayes*, they offer modifications of the generative organs, which differ alike from those of *Helix* and of *Balimus*. *Lamarek*, in ignorance of *Draparnaud*'s genus, proposed his genus *Amphibulima*, which he afterwards suppressed, adopting the name given by *Draparnaud*. The shells are distinguished from *Balimus* by the thin outer lip, and the rapidly enlarging whorls; and from *Limnaea*, to which they more nearly approach in general form, by the columella, which is thin, smooth, and sharp, and destitute of the oblique fold which characterises the columella of the latter genus.

The *Succineæ* are strictly land animals; for, although frequently covered by water and capable of long submersion, they live habitually on land in damp marshy places, near the margins of pools or ditches.

The living species are not numerous, and are found chiefly in temperate climates.

* Etym., *Succineus*, of amber, *i. e.*, amber-coloured.

The fossil species are very few. Two only have hitherto been described; both from the Pleiocene formations, and both referred to living forms, viz., *S. putris* and *S. oblonga*, from the Mammaliferous Crag, (Wood's 'Crag. Moll.,' p. 5). The latter species is also given by M. Nyst, ('Coq. Foss. de Belg.,' p. 446,) as occurring in the corresponding formation in Belgium.

No. 29. *SUCCINEA IMPERSPICUA*. *S. Wood*. Tab. XI, fig. 3 *a—d*.

S. IMPERSPICUA, *S. Wood*. 1847. Lond. Geol. Jour., vol. i, p. 118.

S. testá ovatá, ventricosá, tenui, lavi; spirá brevissimá, obtusá: anfractibus tribus, convexis, ad suturam sub-depressis: aperturá rotundato-ovatá, sub-verticali, bessem totius testæ in longitudinem superanti.

This exceedingly rare shell is thin, smooth, ovate, and composed of three ventricose volutions, rather depressed at the suture. The spire is very short and obtuse; the aperture large, nearly vertical, and in length fully equal to two thirds of the whole shell.

I have three specimens only of this shell: two from Hordwell, for which I am indebted to Mr. S. Wood; the third is from Headon Hill.

Size.—Axis rather more than 2-10ths of an inch; diameter, 3-10ths of an inch.

Section β . *Aquatica*, Fleming.

LIMNOPHILA, *Hartm.*

HYGROPHILA, *Féruss.*

Family—LIMNÆIDÆ.

Genus 12th. LIMNÆA.* *Lamarck*.

BUCCINUM, (sp.,) *Müller*, 1774.

BULIMUS, (sp.,) *Scopoli*, 1777; *Bruguière*, 1792.

LYMNEA, *Lamarck*, 1801; *Risso*, 1826; *Valenc.*, 1833.

LIMNEUS, *Draparnaud*, 1805; *Brogniart*, 1810.

LYMNEUS, *Brard*, 1809; *D'Orb.*, 1841.

LYMNUS, *Montfort*, 1810.

LIMNÆA, *De Férussac*, 1821; *Nilsson*, 1822; *Grateloup*, 1838; *Bronn*, 1838.

LIMNÆUS, *Oken*, 1815; *Rossmasler*, 1835; *Turton*, 1831.

STAGNICOLA, *Leach*, 1820.

GULNARIA, *Leach*, 1820.

* Etym., Λιμναῖος, belonging to, or growing in, pools or marshes.

LYMNÆA, J. Sowerby, 1818; *De Blainville*, 1825; *Desmarest*.

LIMNEA, G. Sowerby, 1822; *Fleming*, 1828; G. Sowerby, Jun., 1840.

— *Swainson*, 1837.

LEPTOLIMNEA, *Swainson*, 1840.

LYMNOPHYSA, *Fitzinger*, 1833.

LYMNULA, *Rafinesque*, 1819.

Gen. Char.—Shell ovate or elongated, frequently turreted, generally thin, smooth; spire always apparent, more or less elevated: volutions convex, somewhat depressed, sometimes ventricose, and rapidly enlarging; aperture large, entire, longitudinal, ovate, with a tortuous columella bearing an oblique fold; peristome sharp edged.

The shells forming this genus, constituted part of the genus *Bulinus* of Scopoli and of Bruguière; they had previously been separated by Müller from the other land and freshwater Molluscs under the generic name *Buccinum*, applied to them by Lister and Geoffroy. In lieu of this name, which has been applied by Linnæus to a group of marine branchiate Molluscs, Lamarck substituted that of *Lymnea*, etymologically Limnæa.

The animal carries on its head two compressed triangular tentacles, enlarged at their bases, at the inner and anterior parts of which the eyes are placed. Like most others of this order, the *Limnææ* are hermaphrodite, and although the union of two individuals is necessary for fecundation, as among the *Helicidæ*, yet impregnation is not mutual, as in that group; but the same animal performs the male and female functions successively with different individuals.

The genus, as at present defined, is composed exclusively of the thick dextral shells, with a fold on the columella, in which the inner lip is not extended over the body whorl; the genus *Amphipeplea*, (Nilsson, the MS. genus *Myxas* of Dr. Leach,) having been proposed for the dextral forms with a plaited columella, in which the shell is thin and polished, and the inner lip expanded. The sinistral forms, without the columellar fold, have been separated under the generic names *Physa* (Draparnaud), and *Aplexus* (Fleming), the *Bulinus* of Adanson. The propriety of these subdivisions is questioned by Mr. G. Sowerby in his ‘Genera of Shells;’ but, besides the conchological differences above mentioned, there are zoological distinctions which are generally admitted as sufficient grounds for retaining them. These are, in *Physa* and *Amphipeplea*, the condition of the mantle, the edge of which is lobed and capable of extension, so as to cover the shell, which thence acquires the polished and shining surface characteristic of those genera; and the form of the tentacles, which are elongated and filiform, and not thick and triangular, as in the present genus. In *Aplexus* the edge of the mantle is, as in *Limnæa*, simple and not extendible over the shell; that genus, therefore, bears the same relation to *Physa* which *Limnæa* bears to *Amphipeplea*.*

* The propriety of these divisions is, to some extent, confirmed by the observations of Mr. W. Thompson, to which I have before referred. That author, speaking of the dentition in the different genera of the Pulmonata, states that “the character of *Limnæus* appears to be to have one small central tubercle, as it were,

The Limnææ are inhabitants of freshwater streams and pools, and occasionally of brackish marshes. The living species are found in all parts of the world, but principally in the temperate zones. In the fossil state, species have been found in the Wealden formations; and they occur in great profusion in the freshwater deposits of the Eocene epoch, and, in greater or less abundance, in nearly all the lacustrine formations above those deposits. In England, as in the Paris basin, the fossil Limnææ occur in very different conditions in the various deposits; in the limestone of the lower formation, called, from the abundance of their remains, the "Limnæan Limestone," specimens with the shell preserved are very rare; generally only the casts are found, the shelly matter having been absorbed. In the upper marls they occur in great profusion, and, although very fragile, usually in a beautiful state of preservation.

It is exceedingly difficult, as both Lamarek and De Blainville have observed, to distinguish the different species; the length of the spire, the contour of the volutions, and the size and shape of the aperture, characters by which species may be separated with tolerable certainty, in other genera, are, in this genus, exceedingly variable, and glide by imperceptible gradations from one extreme to another; so that reliance cannot be implicitly placed on them. The character which appears to exhibit the least variation is the columellar fold, although this also occasionally presents considerable differences in form and condition. By this character, however, the genus may be divided into two groups, one comprising the species in which the fold is flattened; the other consisting of the species in which it is rounded or sub-acute. Each of these groups may, again, be subdivided into two sections, according as the upper parts of the whorls, forming the sides of the spire, are convex or flat. By the use of these artificial distinctions, the separation of the species will be much facilitated.

Sect. *a*. Columellar fold compressed, generally bipartite.

No. 30. LIMNÆA CAUDATA. *F. E. Edwards*. Tab. XII, fig. 2 *a—c*.

L. testâ ovato-acutâ, ventricosâ, lævi: anfractibus numerosis, convexiusculis, ultimo penultimoque rapidè crescentibus: ultimo obsoletè et irregulariter corrugato: spirâ conico-

'squeezed up' between two very large lateral ones, each primary lateral having a very large apex internally, with a small external one, while, at the edge, they have altered to one thick prolonged apex projecting inwards, and irregularly lobed on its upper edge. Much the same arrangement prevails in *Amphipeplea*, where, however, the tubercle of the lateral teeth is even still larger in proportion to its plate. *Physa*, again, exhibits a multitude of teeth of a similar form, though different to any that I have seen in other genera." The dentition of *Aplexus* is not described.

subulatá: aperturá magná, in medio dilatátá, anticè coarctatá, spiram in longitudinem superanti: plicá columellari compressá, proeminenti, valde obliquatá, obscurè sulcatá.

Var. ABBREVIATA; testá anfractibus septem vel octo; spirá breviori; aperturá longiori.

Shell ovate-acute, ventricose, smooth, composed of eight or nine convex volutions, of which the first five or six increase slowly, and the last enlarge rapidly; so that the spire assumes a conical awl-like shape, while the body-whorl is very ventricose. The last two volutions frequently present concentric, obscure, irregular corrugations, giving a crumpled appearance to the shell, similar to that which distinguishes the recent *L. stagnalis*. The aperture is large, effuse towards the middle, but contracted at the anterior part, and somewhat larger than the spire. The columellar fold is flat, prominent, rather strongly twisted, and generally obscurely sulcated.

A variety occurs (fig. 2 c) in which the shell is more ventricose, the whorls fewer, the spire shorter, and the aperture proportionally larger, equalling two thirds of the whole shell.

The *L. caudata*, in its general appearance and awl-like spire, much resembles *L. stagnalis*; but, in the latter species, the whorls are more convex, the body-whorl more ventricose, the posterior part of the aperture more effuse, and the columellar fold is rounded, smaller, and more oblique. Individuals occasionally occur which, from the small degree of convexity in the whorls would, at the first glance, be referred to *L. fusiformis*; but they may be easily separated by the columellar fold, which, in the latter species, is rounded, and presents a more graceful spiral than that of *L. caudata*.

Size.—Axis $2\frac{1}{4}$ inch, nearly; diameter 1 inch.

Localities.—Hordwell Cliff and Headon Hill.

NO. 31. LIMNÆA PYRAMIDALIS. *Desh.* Tab. XIII, figs. 2 a—b, and 3 a—b.

LIMNÆA PYRAMIDALIS. *Desh.* 1824—37. Desc. des coq. foss., &c., vol. ii, p. 95, t. 20, figs. 14, 15.

LIMNÆA „ *J. Sow.* 1825. Min. Con., vol. vi, p. 54, t. 528, fig. 3.

LIMNÆA „ *Bouill.* 1836. Catal., des coq. foss. de l'Auvergne, p. 124.

LYMNÉE PYRAMIDALE? *Brard.* 1810. Ann. du Mus., vol. xv, p. 407, t. 24, fig. 2.

LYMNEUS PYRAMIDALIS? *Fér.* 1814. Mém. geol., &c., p. 60, No. 3.

L. testá ovato-acutá, ventricosá, lævi; anfractibus septem vel octo convexis: aperturá magná, anticè dilatátá, spiram in longitudinem superanti; labio parum expanso; columellá marginatá; plicá columellari magná, compressá, obliquá, in medio sub-bipartitá.

A smooth, ovate-acute, ventricose shell, composed of seven or eight convex whorls, separated by a simple, well-defined, but not deep suture: the aperture, which is fully as long as the spire, is large and effuse; the inner lip but slightly spread over the body-whorl, and the columella presents a margin formed by the thickened inner lip, and bears a prominent oblique fold, obscurely sulcated.

The whorls enlarge more regularly in this species than in *L. caudata*, and the shell, consequently, is more pyramidal in its general form; and the columellar fold is not so prominent nor so much twisted as in that species. From *L. fusiformis* it is distinguished by the greater convexity of the whorls, and the flattened sulcated fold. The rounder whorls, the depression of the upper margin, and the acute fold of *L. cincta*, separate it, as clearly, from that species.

Although M. Deshayes, in his description of *L. pyramidalis*, cites Brard without comment, I feel great difficulty in referring his shell to Brard's *L. pyramidalis*. That shell, judging from the description and figure, is elongated and narrow, and corresponds, as well in the contour and proportion of the whorls and the form of the aperture, as in the character of the depressed columellar fold, with *L. longiscata*, to which species I think it belongs. It certainly appears to differ widely from the ventricose and comparatively short shell described by M. Deshayes, in which the aperture is large and effuse, and the fold prominent.* The English specimens referred to *L. pyramidalis* of M. Deshayes, agree very well with that author's description and figure, but not with Brard's; while, on the other hand, adult specimens of *L. longiscata* frequently occur, which correspond with Brard's *L. pyramidalis*.

The shell represented by fig. 3 *a—b*, for the use of which I am indebted to Mr. Sowerby, is narrower than the type of this species; and the volutions are so flat, and the general shape so fusiform, that, at first sight, it might be referred to *L. fusiformis*. The fold, however, is flattened and sulcated; and I therefore consider it to be merely an aberrant form of *L. pyramidalis*, combining the columellar fold of that species with the flat-sided spire and subfusiform shape of *L. fusiformis*.

Size.—Axis 2 inches; diameter, 9-10ths of an inch, nearly.

Localities.—Hordwell; Headon Hill; and in France, La Villette, Montmartre, and Vergnols, near Aurillac.

No. 32. LIMNÆA LONGISCATA. *Brard*. Tab. XII, fig. 3 *a—h*.

LYMNÉE EFFILÉE. *Brard*. 1809. Ann. du Mus., vol. xiv, p. 432, t. 27, figs. 15, 16.

— PYRAMIDALE, *Brard* (?) 1810. Ib., vol. xv, p. 407, t. 24, fig. 2.

LIMNEUS LONGISCATUS, *Brogn.* 1810. Ib., p. 372, t. 22, fig. 9.

— — *Brogn.* 1811. Jour. de Phys., &c., vol. 72, p. 421.

LYMNEUS LONGISCATUS, *Fér.* 1814. Mém. geol., &c., p. 59, No. 1.

LIMNÆA LONGISCATA, *Sow.* 1823. Min. Con., vol. iv, p. 57, t. 343.

LYMNÆA — *Desh.* 1824. Desc. des coq. foss., &c., vol. ii, p. 92, t. 11, figs. 3, 4.

— — *Desh.* 1824. Encycl. Meth. Vers., t. 2, p. 356, No. 1.

* This want of resemblance between the *L. pyramidalis* of M. Deshayes and that of Brard is noticed by Bouillet in his Catalogue above referred to.

LIMNEA LONGISCATA, *Lyell and Murch.* 1829. Mém. sur les dépôts lacustres tert. du Cantal.

LIMNEA — *Bouill.* 1836. Cat. des coq. foss., &c., p. 157, No. 6.

— — *Gratel.* 1838. Cat. des débris foss., &c., du Bassin de la Gironde, p. 33, No. 100.

LYMNÆA — *Desh.* 1838. Lam. Hist. Nat. &c., 2d edit., vol. viii, p. 422, No. 7.

L. testá lævi, elongatá, sub-turritá, acuminatá: anfractibus sex aut septem, convexiusculis; suturis sub-depressis: aperturá orato-acutá, anticè dilatatá, spiram in longitudinem vix æquantí; labro parum expanso; columellá marginatá; plicá columellari latá, compressá, parum eminenti, bipartitá.

Var. DISTORTA; testá longiori, angustiori, anfractibus plus decurrentibus; aperturá breviori.

This *Limnæa* is more abundant, and, although it presents many varieties of form, is, perhaps, better characterised than any other fossil species. It is a smooth, elongated, narrow, subturrit shell, composed of seven or eight convex whorls, somewhat depressed at the suture. The aperture is oval, rather effuse in front, and, in the typical form, is a little shorter than the spire; the inner lip is thick, but does not extend much beyond the aperture. The columellar fold is broad, flat, not very prominent, and widely but not deeply sulcated.

A variety frequently occurs (fig. 3 *c—h*), in which the line of the suture runs below the wide part of the whorl, giving an irregular distorted appearance to the shell, and shortening the aperture, the length of which barely equals two fifths of the whole shell.

Although there can be but little doubt that this is the true *Lyminée effilée* of Brard, the columellar fold does not correspond with the description given by M. Deshayes, in which it is represented to be small and rounded; but in the few French specimens which I have had an opportunity of examining, the columellar fold corresponds with that of the English specimens. I presume, therefore, that the form described by M. Deshayes was a modification of the more general form.

The shell figured and described by Brard as *L. pyramidalis*, appears to me, as I have already stated, from its elongated narrow shape, the form of the aperture, and the slight elevation of the fold, to be merely an adult specimen of this species—similar to that represented by fig. 3 *c* and *d*. The “double suture,” or “narrow spiral riband,” running along the edge of the suture, which Brard mentions as distinguishing *L. pyramidalis*, frequently occurs in this, as well as in other species; it is not, however, a constant character in any, and cannot be relied upon as a specific distinction.

A form occurs, rather plentifully, in Hordwell Cliff, which Mr. Wood (‘Lond. Geol. Journ.’ vol. i, p. 118,) has referred to *L. strigosa*, (Brogn.) That species, apparently, was proposed from casts or mutilated specimens, and is a questionable

one; M. Deshayes, in fact, ('Descr. des Coq. Foss.,' &c. vol. ii, p. 92,) has suggested that it may be merely a variety of *L. longiscata*. The Hordwell shells, like the French, are shorter, and the whorls are more convex; but they present the characteristic fold of the present species, of which I consider them to be, therefore, only a variety.

Size.—Axis, 2 inches; diameter, 8-10ths of an inch.

Localities.—Hordwell; Headon Hill; Sconce. *French*: Belleville; Saint-Ouen; Fontainebleau; Rochechouart; Veurs, and Vergnols, near Aurillac; Dax.

No. 33. LIMNÆA SULCATA. *F. E. Edwards.* Tab. XIV, fig. 4 *a—b*.

L. testá ovatá; anfractibus quinque vel sex, convexiusculis, substriatis; spirá mediocri, acutá; aperturá ovatá, spiram in longitudinem superanti; margine externo parum obliquo; plicá columellari compressá, vix eminenti, profundè sulcatá.

An ovate shell, composed of five or six slightly convex whorls on which the lines of growth are very conspicuous, imparting a sub-striated appearance to the surface; the spire moderately elevated and pointed. The aperture is ovate, and rather longer than the spire; the outer lip but slightly oblique, and the columellar fold compressed, not very prominent, and more deeply sulcated than in any other species.

In general appearance this species resembles *L. arenularia*; but it may be distinguished by the flat and deeply sulcated fold.

Size.—Axis, rather more than 1 inch; diameter $\frac{1}{2}$ an inch.

Localities.—Hordwell; Headon Hill.

No. 34. LIMNÆA GIBBOSULA. *F. E. Edwards.* Tab. XIV, fig. 8—*c*.

L. testá ovatá, sub-turritá; spirá brevi, sub-acutá; anfractibus sex, gibbosulis, ultimo magno, suturis profundis: aperturá acuto-semi-ovali, amplá, basi effusá, bessem totius testæ in longitudinem superanti; labro reflexo; plicá columellari parvâ, parum tortuosâ, sub-compressâ, obscurè sulcatâ.

An ovate sub-turreted shell, with a moderately elevated and rather obtuse spire: volutions six, somewhat gibbous, separated by a deep suture, and, in some specimens, flattened round the upper margin; the last volution is proportionally large. The aperture is semi-oval, dilated in front, acute behind, and exceeds in length two thirds of the whole shell; the inner lip is reflected; the columellar fold small, somewhat compressed, not much twisted, and obscurely sulcated.

This species resembles *L. sublata* more than any other; but the shell is larger, the spire not so much elevated, the volutions more equally gibbous, the aperture much longer and more effuse at the base, the fold not so much twisted and the outer

lip not so oblique. From *L. tumida* it is separated by the shorter spire and the flat sulcated columella.

Size.—Axis, 1 inch and 7-10ths; diameter, 9-10ths of an inch nearly.

Locality.—Headon Hill.

NO. 35. *LIMNÆA SUBLATA*. *F. E. Edwards*. Tab. XIII, fig. 4 *a—b*.

L. testá ovato-acutá, ventricosá: anfractibus sex, convexis, levibus; aperturá rotundato-semi-ovali, per-obliquá, amplá, spiram in longitudinem paulo superanti; margine externo reflexiusculo; plicá columellari compressiusculá, angustá, parum eminenti, valde tortuosá.

A smooth, ventricose shell, with a moderately elevated spire, and an acute apex: the six whorls of which it is formed are convex, and separated by a conspicuous but not deep suture; the aperture is roundedly semi-oval, effuse, and a little longer than the spire. The outer lip is very oblique, and slightly reflected; the inner one scarcely extends beyond the aperture; the columella is much twisted, and the small narrow fold is compressed and very little prominent.

Owing to the great obliquity of the aperture, the shell must have been carried by the animal with the spire more raised than is usually the case in this genus; from this peculiarity the specific name has been taken.

The present species approaches nearly to *L. gibbosula*, but the spire is longer and more pointed, the whorls more ventricose, and the aperture shorter in proportion, and more oblique. The greater convexity of the whorls, the shorter spire, the narrow, slightly projecting fold, and the effuse and oblique aperture, distinguish it from *L. pyramidalis*. It appears to be rare.

Size.—Axis $1\frac{1}{2}$ inch; diameter 8-10ths of an inch.

Locality.—Headon Hill.

NO. 36. *LIMNÆA MIXTA*. *F. E. Edwards*. Tab. XIII, fig. 5 *a—b*.

L. testá ovato-acutá; spirá elevatá; anfractibus sex vel septem, convexiusculis, longitudinaliter striatis, ultimo magno, sub-ventricoso: aperturá ovali, anticè coarctatá, bessem totius testæ in longitudinem ferè æquanti; plicá columellari sub-rectá, angustá, compressiusculá, parum eminenti, obscure sulcatá.

An ovate shell, with a moderately elevated pointed spire; volutions six or seven, slightly convex, almost flat on the upper parts composing the sides of the spire, and marked more strongly than usual in this genus by conspicuous irregular lines of growth; the body whorl large and rather ventricose. The aperture is oval, contracted in front, and, in length, nearly equal to two thirds of the whole shell; the columellar fold is very little twisted, narrow, slightly flattened, barely prominent, and obscurely sulcated.

I propose this species with hesitation ; it may be only a variety of *L. pyramidalis* or of *L. gibbosula*, but the characters it presents are so mixed, that it is difficult to determine to which species it should be referred. The narrow, flat, and nearly straight fold resembles very closely that of *L. gibbosula* ; but the spire is more elevated, more pyramidal, the volutions more regularly convex, and the aperture not so effuse. It is distinguished from the typical *L. pyramidalis*, not only by the columellar fold, which in the latter species is larger, more oblique, and more prominent, but also by the flatness of the sides of the spire, and the greater length of the aperture ; and from the variety of that species, by the more contracted aperture. In the character of the spire, and the contracted aperture, it approaches *L. fusiformis* ; but it is separated from it by the columellar fold, which in that species is rounded, prominent, and more twisted.

Size.—Axis, 1 inch and 6-10ths ; diameter, 8-10ths of an inch.

Locality.—Headon Hill.

No. 37. LIMNÆA OVUM? *Brogn.* Tab. XIV, fig. 12 *a—b*.

LIMNEUS OVUM, *Brogn.* 1810. Ann. du Mus., vol. xv, p. 374, tab. 22, fig. 13 A, B.

— — *Brogn.* 1811. Journ. de Phys., &c., p. 422.

LYMNEUS — *Férus.* 1814. Mém. geol., &c., p. 60, No. 6.

LYMNÆA — *Desh.* 1824—37. Desc. des coq. foss., &c., vol. ii, p. 97, tab. 11, figs. 15, 16.

— — *Desh.* Encyc. Méth. Vers., vol. ii, p. 361, No. 16.

— — *Bouill.* 1836. Cat. des coq. foss. d'Auv., p. 131, No. 13.

L. testá ovali, sub-ventricosá, acuminatá, sub-lævi; anfractibus sex, convexis, ultimo magno: aperturá mediocri, ad basin sub-dilatatá; columellá marginatá; plicá columellari parvá, compressá, sulcatá, anticé angulatá, parum tortuosá.

As I have not had an opportunity of comparing the English with French specimens of this species, the identification cannot be altogether free from doubt. The English shell is nearly smooth, ovate, and sub-ventricose, with a moderately elevated and pointed spire ; volutions six or seven, separated by a conspicuous but not deep suture. The aperture is not wide, but is a little dilated in front, and is about half the length of the entire shell : the columellar fold is small, compressed, obscurely sulcated, very slightly twisted, and scarcely projects into the aperture ; the anterior margin presents an acute ridge, formed by the prolongation of the sharp edge of the peristome ; the inner lip is slightly reflected.

The aperture is not so contracted in front as M. Deshayes describes that of the French shell to be ; it agrees very well with Brogniart's figure, but not with that given by M. Deshayes, although the latter was taken from Brogniart's specimen. In other respects the English shells do not appear to differ from the French.

In the general contour, and in the proportions of the aperture, the present species closely resembles *L. convexa*; but the small, flat, sulcated fold separates it from that species.

Size.—Axis, 1 inch and 3-10ths; diameter, rather more than 6-10ths of an inch.

Localities.—Headon Hill. *French*: Pierrelaie.

Sect. *b*. Columellar fold rounded or sub-acute.

No. 38. *LIMNÆA FUSIFORMIS*. *J. Sowerby*. Tab. XIII, fig. 8 *a—g*.

LYMNÆA FUSIFORMIS, *J. Sow.* 1818. Min. Con., vol. ii, p. 155, tab. 169, figs. 2-3.

LIMNÆA — *G. Sow.* Genera of Shells.

— — *Lyell and Murch.* 1829. Sur les dépôts lacustres, &c., du Cantal.

L. testá ovato-acutá, sub-fusiformi, lævi; anfractibus septenis vel octonis, sub-planis, ultimo ventricoso: aperturá ovatá, spiram in longitudinem vix æquanti; columellá marginatá; plicá columellari rotundatá aut sub-acutá, parum tortuosá.

Var. DEFORMIS, (fig. 8 *c—e*), *testá breviori; anfractibus sex vel septem, ventricosioribus: aperturá rotundato-ovali, spiram in longitudinem superanti; plicá columellari rotundatá, eminentiori.*

A smooth ovate-acute shell, formed of seven or eight whorls, the upper sides of which are nearly straight, giving a regular conical form to the spire, which is elevated and pointed; the last whorl is ventricose; the lines of growth conspicuous and sharp. The aperture is ovate, moderately large, and nearly as long as the spire; occasionally the anterior part is somewhat contracted, imparting a sub-fusiform shape to the shell. The columellar fold is thick, and, generally, rounded; but sometimes it presents a rather sharp anterior margin; it is slightly and gracefully twisted.

Of this species, as of *L. caudata*, a variety occurs (fig. 8 *c—e*) in which the shell is much shorter, the volutions very ventricose, the aperture roundedly ovate, and the fold rounded and prominent.

The contraction of the anterior part of the aperture, causing the fusiform shape to which Mr. Sowerby refers, frequently occurs, but it is not by any means a constant character; in fact, the aperture is more generally somewhat effuse, as represented in the figure 8.

This species approaches *L. pyramidalis* more nearly than any other of the fossil *Limnææ*; but the flatness of the sides of the spire, and the rounded fold, are characters by which it may easily be distinguished. The variety resembles the short variety of *L. caudata*; but the whorls are more ventricose, and the fold is not compressed and sulcated, as in that species.

Size.—Axis, 2 inches nearly; diameter, 8-10ths of an inch.

Localities.—Hordwell, Headon Hill, Sconce. *French*: Aurillac in the Cantal.

No. 39. LIMNÆA TUMIDA. *F. E. Edwards.* Tab. XIII, fig. 6 *a—b*.

L. testá ovato-acutá, ventricosá, sexies vel septies circumvolutá; spirá elevatá, apice acuminato; anfractibus convexis, ultimo tumido: aperturá ovatá, ampliá, bessem totius testæ in longitudinem fere æquanti; margine columellari reflexo; plicá parum tortuosá, eminenti, rotundatá, in medio sub-callosá.

An ovate, ventricose shell, with an elevated, pointed, rather subulate, spire; volutions six or seven, the early ones increasing in size slowly, the last two more rapidly; the upper parts forming the sides of the spire are rather flattened, as in *L. pyramidalis*; the body whorl large and tumid. The aperture is ovate, and in length nearly equal to two thirds of the whole shell; the anterior margin, where it joins the columella, is slightly reflected; the columella itself is not much twisted, and the fold is prominent, round, and thickened towards the middle.

This species may be distinguished from *L. gibbosula*, by the round columellar fold and longer spire; and from *L. fusiformis*, by the more convex volutions, the tumid body whorl, the longer aperture, and the nearly straight fold.

Size.—Axis, 1 inch and 8-10ths nearly; diameter, 11-10ths of an inch.

Locality.—Headon Hill.

No. 40. LIMNÆA COLUMELLARIS. *J. Sowerby.* Tab. XIII, fig. 9 *a—b*.

LIMNÆA COLUMELLARIS, *Sow.* 1826. Min. Con., vol. vi, p. 53, t. 528, fig. 2.

— — ? *Lyell and Mur.* 1829. Sur les dépôts lacustres, &c., du Cantal.

L. testá ovato-ventricosá, sub-turritá, quinquies vel sexies circumvolutá; spirá brevi, apice acuto; aperturá ovali, dilatatá, bessem totius testæ in longitudinem fere æquanti, plicá columellari rotundatá, callosá, valde contortá, pro-eminenti.

I am indebted to Mr. Sowerby for the use of the original specimen described by him of this species. It is a ventricose, oval shell, with a short pointed spire, and formed of five or six very convex whorls, rather depressed at the suture, whence the shell presents a subturreted appearance; the aperture is large, effuse, and nearly as long as two thirds of the whole shell; the thick, callous-like fold is round, very prominent, and much twisted.

If it were not for the convexity of the whorls and the size of the aperture, I should be inclined to consider this shell to be only a variety of *L. fusiformis*; and that the unusual contortion of the fold, a character to which individuals of that species occasionally approach very nearly, is accidental. But in this species, the pyramidal shape, which always distinguishes the spire of *L. fusiformis*, is altogether wanting. From *L. tumida*, which it resembles in the size of the aperture, it is also separated by the

greater flatness of the sides of the spire and the less prominent and less oblique fold of that species. It appears to be very scarce.

Size.—Axis, rather more than 1 inch; diameter, $\frac{1}{2}$ an inch.

Locality. Hordwell. *French*: Aurillac in the Cantal.

No. 41. *LIMNÆA SUB-QUADRATA*. *F. E. Edwards*. Tab. XIII, fig. 1 *a—b*.

L. testá ovato-oblongá, turritá, lævi; spirá mediocri, apice acuto: anfractibus sex aut septem plano-convexis: aperturá ovatá, anticé dilatátá, spiram in longitudinem superanti; labio incrassato reflexo; columellá subrectá, plicá parvâ, vix eminenti, sub-acutâ.

Shell ovate, oblong, turreted, smooth, with six or seven rather flatly-convex volutions; spire moderately elevated, with an acute apex; aperture ovate, somewhat effuse in front, and rather more than half the length of the whole shell; the inner lip thickened, and a little reflected; the columella nearly straight, and presenting a small, rather sharp fold, which scarcely projects into the aperture.

The turreted and depressedly convex form of the whorls gives a sub-quadrate appearance to this shell, by which, as well as by its nearly straight columella, and sharp and barely prominent fold, it may be distinguished from *L. convexa*, which it most nearly resembles.

Size.—Axis, rather more than $1\frac{1}{2}$ inch; diameter, 8-10ths of an inch.

Locality.—Headon Hill.

No. 42. *LIMNÆA CONVEXA*. *F. E. Edwards*. Tab. XIII, fig. 7 *a—b*.

L. testá ovato-ventricosá, series circumvolutá; anfractibus convexis, lævibus; spirá elevatá, apice sub-acuto: aperturá ovatá, anticé effusâ, spiram in longitudinem superanti; labio reflexo; plicâ columellari pro-eminenti, tortuosâ, rotundatâ.

An ovate ventricose shell, formed of six smooth convex volutions, with a moderately elevated and pointed spire: aperture ovate, effuse in front, and rather longer than the spire; the inner lip slightly reflected; the columellar fold round, prominent, and very oblique.

This species somewhat resembles *L. sub-quadrate*; the whorls, however, are more regularly convex, and do not present the turreted appearance which characterises that shell; and the round columellar fold is much more prominent, and more strongly twisted. In the convexity of the whorls it approaches *L. pyramidalis*, but the flat sulcated fold separates that species from this.

Size.—Axis, 1 inch and 3-10ths; diameter, 6-10ths of an inch.

Locality.—Headon Hill. In Mr. D'Urban's collection.

No. 43. LIMNÆA COSTELLATA. *F. E. Edwards.* Tab. XIII, fig. 10 *a—b*.

L. testá ovato-ventricosá, sub-turritá; spirá mediocri, acuminatá; anfractibus quinque vel sex, convexis, longitudinaliter sub-costellatis, et lineis incrementi subtilissimé striatis; costellis obscuris, irregularibus, remotiusculis: aperturá ovatá, amplá, spiram in longitudinem superanti; labio reflexo; plicá columellari viâ tortuosá, rotundatá, parum eminenti.

The striated *Limnææ* generally acquire that character from the conspicuous lines of growth; but the present species presents obscure costellæ, as well as the striation due to the lines of growth. It is an oval, ventricose, sub-turreted shell, with a moderately elevated spire and pointed apex, and formed of five or six convex volutions, very finely striated by the lines of growth, and also longitudinally costellated; the costellæ are obscure, irregular, and separated by broad shallow sulci, in which the lines of growth are perceptible. The aperture is ovate, rather dilated, and a little longer than the spire; the columellar margin strongly reflected, and the fold rounded, slightly twisted, and but little prominent.

Independently of its costellated character, this species presents differences which prevent its being confounded either with *L. strigosa* (Brogn.), or *L. substriata* (Desh.). In the first species, the shell is more elongated, the aperture smaller, and the columellar fold resembles that of *L. longiscata*, of which I think it is merely a variety; in the latter, the spire is more elevated, the aperture much contracted in front, and altogether narrower; and the fold is prominent and strongly twisted.

The present appears to be a well-marked species.

Size.—Axis, rather more than 1 inch; diameter, 4-10ths of an inch.

Localities.—Hordwell; Headon Hill.

No. 44. LIMNÆA FABULUM. *Brogniart.* Tab. XIV, fig. 10 *a—b*.

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| LIMNEUS FABULUM. | <i>Brogn.</i> 1810. Ann. du Mus., vol. xv, p. 375, t. 22, fig. 16. |
| — — | <i>Brogn.</i> 1811. Journ. de Phys., &c. vol. lxxii, p. 423. |
| LYMNEUS — | <i>Fér.</i> 1814. Mém. geol., p. 61, No. 13. |
| LIMNEA — | ? <i>Lyell and Mure.</i> 1829. Sur les dépôts lacust. tert. du Cantal. |
| LYMNÆA FABULA. | <i>Desh.</i> 1824—37. Desc. des coq. foss., &c., vol. ii, p. 96; t. 11, figs. 11-12. |
| — — | <i>Desh.</i> 1830. Ency. Méth. Vers., vol. ii, p. 361. |
| LYMNEUS FABULUM. | <i>Defr.</i> 1835. Dict. des Sci. Nat., vol. xxvi, p. 462. |
| LIMNÆA FABULA. | <i>Nyst.</i> 1836. Rech. coq. foss. de Hoesselt, &c., p. 20, No. 49. |
| LYMNÆA FABULA. | <i>Desh.</i> 1838. 2d edit. Lam. Hist. Nat., vol. viii, p. 223, No. 9. |
| LIMNEUS FABULA? | <i>Nyst.</i> 1843. Desc. des coq. &c. foss. des Terr. tert. de Belg., p. 469, t. 38, fig. 18. |

L. testá ovato-ventricosá, lavi, acuminatá; anfractibus quinque vel sex, convexiusculis: aperturá ovato-acutá; plicá columellari sub-acutá, parum tortuosá.

A smooth, ovate, ventricose shell, with a short pointed spire, and formed of five or six slightly convex whorls; the aperture pointedly ovate, and the columellar fold somewhat angular and prominent, but not much twisted.

I have not had an opportunity of comparing the English with the French shells, and I have therefore some hesitation in pronouncing as to their identity. My specimens, however, agree very well with the description and figures given by M. Deshayes, (which it must be remembered are taken from casts merely,) except that the French shell is described as formed of four whorls only, and as having the aperture contracted at the base; but the figures show six whorls, and the aperture, as drawn, is scarcely more contracted than that of the English shell.

Size.—Axis, rather more than 8-10ths of an inch; diameter, 4-10ths of an inch.

Localities.—Hordwell. *French*: Jouy; Saint-Prix, Montmorency; Pierrelaie and Lavergnol in the Cantal. *Belgian*: Kleyn-Spauwen.

NO. 45. *LIMNÆA CINCTA*. *F. E. Edwards*. Tab. XIV, fig. 5 *a—b*.

L. testá elongato-ovatá, sub-turritá, sexies vel septies circumvolutá; spirá exsertá, acuminatá; anfractibus convexis, substriatis: aperturá rotundato-ovatá, amplá, spiram in longitudinem æquantí; plicá columellari parvâ, angustâ, rotundatâ, parum tortuosâ, proeminenti.

An elongated ovate shell, with an elevated pointed spire; volutions six or seven, very convex, almost ventricose, the edges of which are depressed along the suture, and, generally, present a sharp stria running round them, parallel with and at a short distance below the suture,—similar to that mentioned by Brard as characterising his *L. pyramidale*: the lines of growth are so strongly marked that the surface of the shell almost appears to be striated. The aperture is roundedly ovate, somewhat effuse, and barely exceeds the spire in length; the columellar fold is narrow, rounded, not much twisted, and prominent.

The line of suture frequently runs below the wide part of the whorl, giving a distorted appearance, resembling that which is sometimes seen in *L. longiscata*, and in fact the present shell presents a close analogy with that species. It is, however, distinguished from *L. longiscata*, as well as from *L. pyramidalis* (Desh.), by the round columellar fold, and the greater convexity of the whorls.

Size.—Axis, $1\frac{1}{2}$ inch; diameter, rather more than $\frac{1}{2}$ an inch.

Locality.—Headon Hill.

No. 46. LIMNÆA ANGUSTA. *F. E. Edwards*. Tab. XIV, fig. 6 *a—b*.

L. testá angustá, elongatá, sub-turritá, quinquies vel sexies circumvolutá; spirá elevatá, acuminatá; anfractibus convexis, lineis incrementi obscuré striatis: aperturá ovato-oblongá, anticé sub-dilatatá, spiram in longitudinem parum superanti; plicá columellari crassá, tereti, parum eminenti, sub-tortuosá.

If it were not for the thick, round, columellar fold, and the elongated aperture, I should refer this species to *L. longiscata*, which it much resembles. It is a narrow, elongated, sub-turreted shell, formed of five or six convex volutions, obscurely striated by the lines of growth; the spire elevated and pointed. The aperture is a longish oval, equal to half the length of the shell, and rather spread out in front; the columellar fold is thick, round, not very prominent, and but slightly twisted.

The long narrow shape of this shell separates it from every species except *L. longiscata*; from the latter shell it is easily distinguished by the fold, so opposite in character to the broad, flat, sulcated fold which characterises that species.

Size.—Axis, $1\frac{1}{4}$ inch; diameter, not quite $\frac{1}{2}$ an inch.

Localities.—Hordwell; Headon Hill.

No. 47. LIMNÆA ARENULARIA. *Brard*. Tab. XIV, fig. 13 *a—b*.

LYMNÉE DES GRES. *Brard*. 1810. Ann. du Mus., vol. xv, p. 409, t. 24, fig. 5-6.

LYMNEUS ARENULARIUS. *Féruss*. 1814. Mém. geol. &c. p. 61, No. 15.

LIMNÆA ARENULARIA. *Desh*. 1824—37. Desc. des coq. foss., &c., vol. ii., p. 93, t. 11, figs. 7-8.

L. testá ovato-acuminatá, sub-turritá, lavi; anfractibus septenis, convexiusculis, suturis conspicuis: aperturá amplá, semi-ovali, spiram in longitudinem superanti; plicá columellari rotundatá, minimá, parum contortá, sub-proeminenti.

A smooth, ovate, oblong sub-turreted shell, with a moderately elevated and tapering spire; volutions seven or eight, slightly convex, separated by a conspicuous, but not deep, suture, and occasionally striated by faint lines of growth: the aperture rather large, semi-oval, a little dilated in front, and longer than the spire; the columellar fold rounded, small, slightly twisted, and not very prominent.

The English shells correspond so nearly with M. Deshayes's figures, and with some French specimens, for which I am indebted to that gentleman, as not to leave any doubt as to this identification, notwithstanding that M. Deshayes describes the aperture as very oblique, and the columellar fold as much twisted, characters which I have not found prominent either in the English or French specimens.

Size.—Axis, 4-10ths of an inch; diameter, 7-20ths of an inch.

Localities.—Hordwell; Headon Hill. *French*: Beauchamp, near Pointoise, Valmondois.

No. 48. *LIMNÆA MINIMA*. Sowerby. Tab. XIV, fig. 9 a—c.

LYMNÆA MINIMA. Sow. 1817. Min. Con. vol. ii, p. 156, t. 169, fig. 1.

L. testá minimá, ovato-elongatá, lævi; anfractibus quinque aut sex, convexiusculis: aperturá ovali, spiram in longitudinem vix æquanti; margine columellari reflexo; plicá sub-rectá, rotundatá, parum eminenti.

It is not unlikely that this, as Mr. Sowerby has suggested, may be the young shell of some species already described, probably of *L. arenularia*, to which, in its regularly taper spire and rounded fold, it presents a close approximation. It is a very small, smooth, elongated, ovate shell, with five or six rather convex volutions, separated by a moderately deep suture: the aperture is ovate, and rather less than half the length of the entire shell; the inner lip is strongly reflected, and the fold is round, nearly straight, and very little prominent.

The figures are taken from the original specimen described by Mr. Sowerby in 'Mineral Conchology.'

Size.—Axis, 3-10ths of an inch nearly; diameter, 2-10ths nearly.

Locality.—Headon Hill.

No. 49. *LIMNÆA RECTA*. F. E. Edwards. Tab. XIV, fig. 7 a—b.

L. testá ovato-ventricosá, sub-turritá; spirá mediocri, apice acuto; anfractibus sex aut septem, convexis: aperturá ovali, amplá, anticé dilatatá, longiori quam spira; margine columellari sub-reflexo; plicá parvâ, vix tortuosâ, parum eminenti.

The convexity of the whorls, the pointed spire, and the nearly straight rounded fold, distinguish this from every other fossil species. It is a short ovate shell, with a moderately elevated spire, and an acute apex; volutions six or seven, very convex, the last one rather ventricose: the aperture large, of a roundedly ovate form, effuse in front, and longer than the spire; the inner lip slightly reflected, and the small rounded fold nearly straight, and scarcely impinging upon the aperture.

This shell much resembles *L. ovum* (Brogn.); but the volutions are fewer and more ventricose, and the aperture is more effuse. It does not appear to me to be referable to any other species; and I have therefore, although reluctantly, described it as a distinct species.

Size.—Axis, 1 inch and 1-10th; diameter, 5-10ths of an inch.

Locality.—Headon Hill.

No. 50. *LIMNÆA TENUIS*. *F. E. Edwards*. Tab. XIV, fig. 11 *a—b*.

L. testā tenui, ovato-ventricosā, sub-turritā; anfractibus sex, convexis, ultimo magno; apice acuto: aperturā ovatā, effusā, in longitudinem bessem totius testæ ferè æquantī; plicā columellari brevi, angustā, rotundatā, parum tortuosā.

This species presents so close an analogy with *L. tumida*, that it would be difficult to separate the two, if it were not for the great difference in size. The shell is very thin, ovate, and formed of six convex volutions, depressed round the suture, which character imparts to it a sub-turreted appearance; the spire is somewhat elevated and pointed; the body-whorl large and ventricose: the aperture ovate, effuse, and nearly as long as two thirds of the entire shell; the columellar fold short, narrow, rounded, and not much twisted.

Size.—Axis, 8-10ths of an inch; diameter, 4-10ths of an inch.

Locality.—Headon Hill.

Genus 13th. *PLANORBIS*. *Geoffroy*.

CORETUS, *Adanson*, 1757.

PLANORBIS, *Geoffroy*, 1767; *Guettard*, 1770; *Müller*, 1773-4.

Gen. Char.—Shell discoidal, spire depressed; volutions apparent above and below, convoluted upon a nearly horizontal plane, thin, generally smooth, ventricose, sometimes carinated: aperture simple, lunate, crescent-shaped or sub-quadrate, impinged upon by the preceding volution; outer lip generally thin, sharp edged, sometimes thickened or reflected; columellar lip slightly spreading over the body whorl. No operculum.

The animals belonging to this genus were placed by Linnæus among the *Helices*; they had, however, been separated, as a distinct group, by Lister, nearly a century previously, and formed the third section of the *Lacustrine* shells of that author. Shortly before the publication of the *Systema Naturæ*, Adanson described a small species to which he gave the generic name *Coretus*. The genus was afterwards defined by Geoffroy under the present name *Planorbis*; and Müller, to whom it has been generally attributed, only adopted Geoffroy's name.

The animal of *Planorbis* is elongated, slender, and strongly rolled up; the head is furnished with two long contractile tentacles, at the internal bases of which the eyes are placed; the orifices are on the left side; the organs of generation distinct.

Whether the shell of *Planorbis* is dextral or sinistral is a question which has been much discussed, and, by some authors, is considered as still undecided. By Linnæus, Müller, and subsequent writers to the time of Cuvier, it was regarded as dextral, and was described as *supra umbilicata*. The transposition in *P. corneus* of the

orifices and the heart, all of which are on the side contrary to that in which they are placed in the animals of dextral shells, induced Cuvier to consider that species as sinistral: and in this opinion many eminent naturalists have concurred. M. Desmoulins, however, has ascertained, by a careful anatomy of the animal of *P. cornuus*, that, although the orifices and the heart have an abnormal position, the organs of digestion and generation, in fact, retain the position they hold in dextral molluscs; and that author, therefore, maintains that nearly all the known species of *Planorbis*, as well living as fossil, are dextral. M. Deshayes concurs in this opinion; and, after remarking that the upper side may be distinguished from the under side by the obliquity of the aperture, the superior margin of which is more produced, cites the observations of M. Desmoulins as explaining the apparent anomaly of a sinistral animal in a dextral shell, and how, in reality, the animal is dextral as well as the shell; there not being any other derangement in the relation of its organs than with regard to the heart and the termination of the digestive and generative organs. With regard to the shell, it will be seen at once, on observing the manner in which it is carried by the animal, that it is dextral, and that, as Mr. Benson has stated,* if it be viewed practically as sinistral, and placed as such, the animal will be on its back, and will have to twist its body half round in order to gain the ground with its foot. Mr. Benson, therefore, proposes to consider that face as containing the apex, in discoidal shells, which is contiguous to the back of the animal; and, he adds, this side may invariably be known in *Planorbis* by the greater projection of the lip in that part, by the deeper depression of the central umbilicus, and by the more considerable involutions of the whorls occasioning a greater depth of suture. Mr. G. Sowerby, on the other hand, asserts† that the shell is sinistral, and that it is only needful to observe on which side of the shell the very apex of the spire is actually to be seen, and, taking that side for the upper, in conformity with the strict rules of analogy, it will immediately be evident that the aperture is on the left side. This criterion, however, is seldom available; for, in general, the apex is concealed by the involution of the whorls, and the shell presents, on each face, what may be easily mistaken for an umbilicus; and the difficulty in determining which face contains the apex, and which the true umbilicus, is not removed. It is well known that testaceous molluscs, when placed in conditions unfavorable to healthy development, frequently depart from their normal form; and that their shells, in consequence, are distorted, and become what are usually called monstrosities. Thus, in *Planorbis*, the animal, under such conditions, frequently loses, to a greater or less degree, its strong convolution on a horizontal plane; and the shell assumes, in conformity, a more or less elongated spiral form, with an elevated apex. M. Desmoulins cites these monstrosities in support of his opinion, observing that, when they occur, the whorls gradually glide from left to right, down the imaginary

* Journal Asiat. Soc. Bengal, vol. v, p. 744.

† Genera of Shells. Gen. *Planorbis*.

axis. A series of such distorted specimens of *P. complanatus*, taken from a pond near Swansea, formed, I believe, by the waste water from a steam-engine, and of a high temperature, is in the British Museum. These specimens have all assumed an elevated spiral form; and the aperture is in every case dextral. Several specimens of *P. vortex*, in Mr. Sowerby's Museum, are similarly distorted; and in them also the apertures are dextral. On the whole, the better opinion appears to be that the shell, as well as the animal, is dextral, notwithstanding the abnormal position of the heart and the orifices; and in the following descriptions, therefore, I have considered the shell as dextral, and I have applied the term *upper* to that disc which is uppermost when the shell is placed with the mouth on the right side of the spectator, and the term *under* to the opposite disc.

The *Planorbes* live in fresh water; more frequently in stagnant water or standing pools, although, occasionally, they are found in gentle streams. They are widely diffused, but abound principally in temperate climates. I believe that at present there is not any species known as living in salt or brackish waters; and the specimens found in the crag formation, and described by Mr. Wood, are referred to recent species which are known to be pure fresh-water animals; and these shells are therefore considered to have been accidentally introduced.

Four species also occur in the estuarine or fluvio-marine deposits of the Eocene epoch: viz., *P. hemistoma* (Sow.); *P. obtusus* (Sow.); *P. biangulatus* (nov. spec.); and *P. elegans* (nov. spec.); but, like the crag specimens, they have, probably, been deposited there by the agency of some river: they all occur in the pure fresh-water or the transition formations.

Fossil species are numerous, but they abound principally in the formations of the tertiary epoch; Prof. E. Forbes, however, states, (Brit. Mol., vol. iii, p. 146,) that representatives of the genus, differing but slightly from species still living, are found in fresh-water strata of even the oolitic epoch.

No. 51. PLANORBIS EUOMPHALUS. *Sowerby*. Tab. XV, fig. 6 a—c.

PLANORBIS EUOMPHALUS. *J. Sowerby*. Min. Con., vol. ii, p. 92, t. 140, figs. 7—9.

— — *G. Sowerby*. Genera of Shells, fig. 5.

— — *Deshayes*. Lam. Hist. Nat., 2d edit., vol. viii, p. 397, No. 9.

P. testá supra sub-planá, ad peripheriam angulatá, subtus latè et profundè cavatá; anfractibus sex, sub-trigonis, vix involventibus, transversim lineis incrementi notatis, aliquandoque concentricè striatis; subtús ad marginem umbilicalem obtusè angulatis; striis concentricis numerosis, irregularibus: aperturá per-obliquá.

This well-known species, which at present appears to be confined to the fresh-water formations of England, is easily distinguished from the other fossil *Planorbes*. It is a large discoidal shell, nearly flat on the upper face, and presenting a wide and

deep umbilical cavity beneath; the six or seven volutions of which the shell is formed, are flat, or nearly so, above; convex below; and each but slightly embracing the preceding volution; the apex is concealed by the involution of the whorls. A clearly defined and rather acute angle, almost forming a keel, runs round the periphery of the shell, and separates the upper from the under disc. This angle is always very conspicuous in young shells; but as they approach maturity, it becomes more and more obtuse, and frequently altogether disappears; the whorls then assume a transversely oval form, approaching nearly to that presented by *P. rotundatus*. On the under surface, the inner margins of the whorls are bent rather suddenly towards the preceding whorl, and present, in consequence, an obtuse angle, which runs round and defines the umbilicus. Transverse lines of growth are very conspicuous; and frequently the surface of the shell also presents more or less numerous concentric raised lines, some of which are larger and more prominent than the rest. The aperture is sub-trigonal, slightly impinged upon by the preceding volution, and very oblique.

This species presents a general resemblance to *P. rotundatus*; but, even when the characteristic angle has become obsolete, it may easily be distinguished by the greater breadth, and the flatness of the upper surfaces, of the whorls, the much larger concavity on the under side of the shell, and the subtrigonal and more oblique aperture. From *P. discus* it is separated by the more compressed form of that species, caused by the greater width of the whorls, and the comparative flatness of their under sides; and in that species the whorls are more embracing than in this.

Size.—Diameter, 1 inch and 6-10ths.

Localities.—Headon Hill; Hordwell.

No. 52. *PLANORBIS ROTUNDATUS*. *Brard*. Tab. XV, fig. 4 *a—c*.

PLANORBE ARRONDI. *Brard*. 1809. Ann. du Mus., vol. xiv, p. 433, t. 27, figs. 19, 20.

PLANORBIS ROTUNDATUS, *Brogn*. 1810. *Ib.*, vol. xv, p. 370, t. 22, figs. 4, 5.

— — *Ib.* 1811. Jour. de Phys., vol. lxxii, p. 419, figs. 4, 5.

— *SIMILIS*. *Fér.* 1814. Mém. geol., p. 61, No. 1.

— *ROTUNDATUS*. *Fér.* 1814. *Ib.*, No. 2, var. A.

— — *Desh.* 1824—37. Desc. des coq. foss., vol. i, p. 83, t. 9, figs. 7, 8.

— — *Desh.* 1824—37. Encycl. Meth. Vers., &c., vol. iii, p. 778, No. 2.

— — *Bowd.* Elem. of Conch., t. iv, fig. 7.

— — *Lyell and Mur.* 1829. Sur les dépôts, &c. du Cantal.

— — *Bouillet.* Desc. hist. et scient. de la Haute Auver., p. 18, figs. 6, 7.

— — *Ib.* 1836. Cat. des coq. viv. et foss. de l'Auver., p. 115, No. 2.

— — *Gratel.* 1838. Cat. des deb. foss., &c., du bassin de la Gironde, p. 33, No. 102.

— — *Desh.* 1838. Lam. Hist. Nat., 2d edit., vol. viii, p. 394, No. 1.

P. testá lævi sub-striatáve, supernè sub-planá, subtus concavá; anfractibus sex vel septem, rotundatis, vix involventibus, infernè ad marginem umbilicalem sub-angulatis; suturis profundis: aperturá parum obliquá.

A rather large shell, formed of six or seven nearly round volutions, separated by a deep suture, and each slightly impinged upon by the preceding one; the volutions are flatly convex on the upper sides, convex beneath, and, like those of *P. euomphalus*, present an angle running round the inner margins near the umbilicus, which, as the shell approaches maturity, becomes almost obsolete. The upper face is nearly flat; while the under side presents a moderately deep and wide concavity. The aperture is transversely oval, and but slightly oblique. The striæ of growth are very conspicuous; and occasionally, although very rarely, the shells present fine concentric lines, similar to those which characterise *P. euomphalus*; in this species, however, the lines are finer and more crowded, and seldom extend beyond the first three or four volutions.

Brard states that, in *P. arrondi*, the whorls are perfectly round, and do not impinge upon the succeeding whorls; and in these respects his shell does not agree with the English specimens; but the figures, apparently, are taken from a cast, and the disagreement may probably be attributed to that circumstance. Brogniart's fig. 4, (var. A, of that author,) agrees very well with our specimens, except that the aperture is more oblique. In the figure given by M. Deshayes, the whorls are wider and more flattened on the upper surface, and the upper margin of the aperture appears to be more produced than in any English specimen I have seen; the shell, too, is larger than our shells, and, in fact, strongly resembles those specimens of *P. euomphalus* in which the characteristic angle round the whorls has become obsolete.

The general resemblance and the distinctions between the present species and the recent *P. corneus*, have been pointed out by the French authors cited; and, on comparing the two, it will be seen that in the latter species the whorls are fewer, rounder, and enlarge more rapidly, and that in consequence, the shell is deeper and more largely umbilicated than the fossil species.

MM. Férussac and Deshayes mention a variety (probably the var. B of Brogniart) in which the shell is smaller, rather more compressed, and nearly equally concave above and below; I have not met with this variety among the English specimens.

Size.—Diameter, 1 inch and 2-10ths.

Localities.—*English*: Sconce; Headon Hill; Hordwell. *French*: Aurillac, La Vissière, Lavergnol, in the Cantal; Saint-Prix; Palaiseau, Milon near Versailles; Triel; Fontainebleau; La Vilette.

No. 53. *PLANORBIS OBTUSUS*. Sowerby. Tab. XV, fig. 1 *a—e*.

PLANORBIS OBTUSUS. *Scw.* 1818. *Min. Con.*, vol. ii, p. 91, t. 110, fig. 3.

P. testá depressá, laevi; supernè convexiusculá, subtús concavá: anfractibus quinis, obtusé-ovalibus, sese partim involventibus; suturis profundis: aperturá per-obliquá, obcordatá.

This very pretty shell has a smooth, shining, nearly polished surface; it is depressed, nearly flat on the upper side, and moderately concave beneath. The volutions are five, separated by a deep suture, slightly convex on both faces, but rather more compressed on the under side than on the upper, obtusely rounded at the periphery, and each nearly half concealed by the succeeding volution. The aperture is very oblique and bluntly heart-shaped.

In the general form and rounded whorls, this species much resembles *P. sparnacensis* (Desh.), but the whorls are not so numerous, and the aperture is more oblique. The lenticular form and angulated margin of *P. lens*, will prevent its being confounded with that species.

Size.—Diameter, 7-10ths of an inch.

Localities.—Sconce; Headon Hill; Upper mar., Hordwell.

No. 54. *PLANORBIS DISCUS*. *F. E. Edwards*. Tab. XV, fig. 7 *a—d*.

P. testá valde compressá, quinquies circumvolutá, supernè planá, subtus profundè cavatá: anfractibus sex, rapidè crescentibus, parum involventibus, subtus convexiusculis, ad marginem umbilicalem angulatis: aperturá per-obliquá, elongato-cordatá.

This well-marked species appears to be peculiar to the fresh-water formation at Sconce. It is a much compressed discoidal shell, nearly flat on the upper side and deeply hollowed out below. The five or six whorls of which it is formed enlarge rapidly, and each is slightly embraced by the succeeding one; they are much flattened above, slightly convex below, and obtusely rounded at the outer edge. In the young state, the inner margin is bent rather abruptly towards the preceding whorl, and presents an obtuse angle which defines the umbilicus, similar to that presented by *P. euomphalus* and *P. rotundatus*. As the shell approaches maturity, the under side assumes an almost regularly convex form, and the angle becomes obsolete. The aperture is very oblique, and of an elongated heart-shape.

The species which most resemble the present are *P. euomphalus* and *P. oligyratus*. From the first of these, it is distinguished by its more compressed discoidal form, and the rounded periphery. The whorls also enlarge more rapidly, and are consequently fewer and broader; and they embrace more of the preceding one than do those of *P. euomphalus*. The umbilical cavity also is not so wide. It is more difficult to

separate the present species, in the young state, from *P. oligyratus*; but, in the latter, the axis is longer, the whorls are more convex on the upper side, and the obtuse angle which runs round the periphery, near the upper surface, gives a subtrigonal form to the whorls and the aperture, quite distinct from the transversely oval form in the present species.

Casts of this *Planorbis* occur in great abundance, but specimens with the shell preserved are extremely rare.

Size.—Diameter, 1 inch and 6-10ths.

Locality.—Sconce.

No 55. PLANORBIS OLIGYRATUS. *F. E. Edwards.* Tab. XV, fig. 3 *a—c*.

P. testá supernè sub-planá, subtus caratá: anfractibus quaternis, rapidè crescentibus, parum involventibus, ad peripheriam obtusè angulatis: subtus ad marginem umbilicalem angulatis: aperturá sub-trigoná, parum obliquá.

The present, like the preceding species, is apparently confined to the fresh-water formation at Sconce; but it is not so plentiful as *P. discus*. It is a moderately-sized shell, formed of four rapidly increasing whorls, somewhat convex above, and rather acutely angulated round the inner margins on the under side, just above the umbilicus. The periphery, near the upper surface, presents an obtuse angle, from which the whorls slope rather abruptly towards the umbilicus, assuming, in consequence, a subtrigonal form. The aperture is slightly oblique and bluntly obcordate, in consequence of its being impinged upon by the preceding whorl. The umbilical cavity is deep, but not very wide.

This species somewhat resembles the young shell of *P. discus*; but the greater convexity of the under side of the whorls, and the small degree of obliquity, and the shape of the aperture, will distinguish it. The adult shell of *P. discus* is easily separated by its greater size and compression.

The specimens ordinarily found are, like those of the preceding species, casts merely; with the shell preserved they are very rare.

Size.—Diameter, 7-10ths of an inch.

Locality.—Sconce.

No. 56. PLANORBIS PLATYSTOMA. *S. Wood.* Tab. XV, fig. 2 *a—d*.

PLANORBIS PLATYSTOMA. *S. Wood.* Lond. Geol. Journ., vol. i, p. 118.

P. testá parvâ, utrinque fere equaliter cavatâ; anfractibus trinis, rotundatis, tumidis, rapidè crescentibus, supra depressiusculis, subtus convexis, singulo fere dimidium antecedentis involventi: aperturâ magnâ, per-obliquâ, obtusè obcordatâ, peristomate aliquando reflexo.

A small smooth shell, formed of three tumid rapidly-enlarging whorls, each embracing about one half of the preceding one; the whorls are rounded, almost equally convex above and below, but a little compressed on the upper side. The apex is wholly concealed by the involution of the whorls. The aperture is wide, very oblique, and bluntly heart-shaped; sometimes, in the adult shell, the peristome is reflected. The upper side is slightly concave, and the under side presents a wide and moderately deep umbilicus.

This species, which appears to have been first noticed by Mr. Wood, is so well marked that it cannot be confounded with any other. It somewhat resembles the young shell of *P. oligyratus*; but, in the latter shell, the whorls are not so embracing, the upper side is more flattened, and the under side is not so regularly convex. The aperture, also, is narrower and much less oblique. The reflected lip, which frequently occurs in the present species, evidences the maturity of the shell; and the difference between the size of such specimens and that of the fully formed shell of *P. oligyratus* confirms the separation of the two species. In addition to these distinctions, it may be stated that the present species is found plentifully both in Headon Hill and at Hordwell; but that as yet no specimen of *P. oligyratus* has been found at either of those localities.

Size.—Diameter 3-10ths of an inch.

Localities.—Hordwell; Headon Hill; and Sconce.

No. 57. *PLANORBIS LENS*. *Brogniart*. Tab. XV, fig. 8 a—d.

PLANORBIS LENS. *Brogn.* 1810. Ann. du Mus., vol. xv, p. 372, t. 22, fig. 9.

— — *Ib.* 1811. Journ. de Phys., &c. vol. lxxii, p. 421.

— — *Fér.* 1814. Mém. geol., p. 61, No. 10.

— — *Sow.* 1818. Min. Con., vol. ii, p. 91, t. 140, fig. 4.

— — *Desh.* 1824—37. Desc. des coq. foss., &c., vol. ii, p. 87, t. 9, figs. 11—13.

— — *Bouill.* 1836. Catal. des coq. foss. de l'Auvergne, p. 115.

— — *Desh.* Ency. Méth. Vers., &c., vol. iii, p. 783, No. 16.

— — *Ib.* 1838. Lam. Hist. Nat., 2d edit., vol. viii, p. 396, No. 7.

— *Morris.* 1843. Cat. Brit. Foss., p. 156.

An. PLANORBE ANGULEUX? *Brard.* 1810. Ann. du Mus., vol. xiv, p. 435, t. 27, figs. 23-4.

P. testá parvá, lenticulari, lævi, utrinque parum, sed plus superne quam subtus, cavatá; anfractibus quaternis, singulo fere dimidium antecedentis involventi; supra convexiusculis, subtus plano-convexis, ad peripheriam acutè angulatis; aperturá parum obliquá, elongato-cordatá.

Mr. Sowerby, when he gave the name *P. lens* to a British fossil, appears not to have been aware that that name had previously been dedicated by Brogniart to a shell from the Paris basin; but, by a singular coincidence, the shells described by

these authors appear to agree so closely that they must be referred to the same species. I have not, it is true, had an opportunity of comparing the English with the French shells; the identification, therefore, rests entirely on the figures and descriptions given by MM. Brogniart and Deshayes; but, forming my opinion from them, I cannot see any sufficient reason for considering the English shells as distinct. The present species is a small lenticular shell, slightly concave on each disc, but more so on the upper than on the under side: the whorls are four or five, each embracing nearly one half of the preceding whorl; they are slightly convex on both surfaces, but more so above than beneath, and acutely angulated round the periphery, a little below the middle of the whorl. The aperture is of an elongated heart-shape, and not very oblique.

Brogniart describes his shell as swelled out (*bombé*) and lenticular rather than umbilicated; and this, owing to the slight concavity of the discs, may be taken as the general character of the English shell. M. Deshayes, whose figures are drawn from the original specimen, states that in Brogniart's figure the shell is represented with the sides too much swelled out, and with the marginal angle too near the middle. Making due allowance for these errors, it will be seen that the contour of the shell and the form of the aperture represented by Brogniart's middle figure, agree very well with those of the English specimens.* In the figure given by Mr. Sowerby the aperture is represented as very obcordate, and it conveys the idea of the whorls and the shell being more convex than they really are. M. Bronn, in his '*Lethæa geognostica*,' (p. 1011,) states that the shell described by Mr. Sowerby is more depressed than that of the typical *P. lens*, and he refers it to a distinct species, which he has named *P. Sowerbyi*. I fear that M. Bronn had not authentic specimens of our *P. lens* before him; for the figures he has given (Tab. XL, fig. 17 *a—c*.) do not correctly represent that shell; but they, as well as his description, agree closely with another of our Eocene *Planorbis*, which I have therefore referred to his species. The *P. lens* of '*Mineral Conchology*' appears to me, as I have already stated, to correspond so closely with Brogniart's *P. lens*, that the two cannot be separated.

Férussac quotes Brard's *Planorbe anguleux* as a synonym; but whether the present species really is the same cannot well be determined without reference to the original specimen, as both the description and the figure given by Brard are too imperfect for the purpose of identification. I have, however, followed the example of MM. Brogniart and Deshayes, in quoting Brard with a query.

Size.—Diameter, 3-10ths of an inch nearly.

Localities.—Hordwell, and Headon Hill, where it is moderately plentiful. *French*: Saint-Chaumont, Pantin, Limagne, Cournon.

* Judging from the aperture, Brogniart's figures are reversed, probably owing to an oversight of the artist.

No. 58. *PLANORBIS TROPIS*. *F. E. Edwards*. Tab. XV, fig. 10 *a—d*.

P. testá minútá, depressá, lævi, superne parum concavá, subtus late umbilicatá: anfractibus quaternis vel quinis, lente crescentibus, supra convexiusculis, infra sub-planis, ad peripheriam carinatis, singulo dimidium antecedentis obtegenti: aperturá obliquá, angusticordatá.

Mr. Wood ('London Geol. Journ.,' vol. i, p. 118,) has referred this species to *P. planulatus* (Desh.), observing, however, that "the figure by Deshayes is not so flat and carinated as the English specimens, which more resemble the *P. exacutus* (Gould)." I have not seen any French specimens of *P. planulatus*; but, on comparing the English shells with the description and figures given by M. Deshayes, I cannot concur in referring them to that species. *P. tropis* is a minute, compressed, polished shell, a little sunk round the apex, and widely but not deeply umbilicated; the four or five volutions, of which it is formed, are slightly convex above, nearly flat beneath, and compressed near the outer margin so as to present a prominent keel, which runs round the periphery a little below the middle of the whorl. The whorls are much concealed, each embracing about one half of the preceding one; the aperture is very oblique and of a longish heart shape.

Although the general resemblance between this species and *P. planulatus* must be admitted, yet there are, I think, sufficient grounds for specific distinction. In the present species, the whorls increase more slowly and are more concealed; they are not so convex above nor so flat beneath, and, consequently, the keel is near the middle of the shell, and the aperture assumes an elongated heart shape; whereas, in *P. planulatus*, owing to the greater flatness of the under surface of the whorls, the marginal angle (for, judging from the figure given by M. Deshayes, the term *keel* is not applicable,) runs round the base of the shell, and the aperture is sub-trigonal. The English shell also appears to be smaller than the French one. On these grounds, notwithstanding the distrust I feel at dissenting from Mr. Wood's opinion, I consider the present to be a distinct species. In the character and position of the keel, *P. tropis* corresponds with *P. exacutus*; but in the recent shell, the whorls enlarge more rapidly and are more convex, both above and below; the umbilicus is deeper, and the aperture wider, than in the present species.

Size.—Diameter, not quite 3-20ths of an inch.

Locality.—Hordwell.

No. 50. *PLANORBIS HEMISTOMA*. *Sowerby*. Tab. XV, fig. 11 *a—d*.

PLANORBIS HEMISTOMA. *Sowerby*. 1818. Min. Conch., vol. ii, p. 91; t. 140, fig. 6.

P. testá minútá, depressá, lævi, superne profundé cavatá, subtus subplaná, ter quaterve circumvolutá; anfractibus vix involventibus, ad peripheriam sub-angulatis, supra convexi-

usculis, ad marginem sinistram acutè angulatis; infra subplanis; aperturá parum obliquá subtrigóná.

A minute, smooth, much depressed shell, deeply concave on the upper side, almost flat on the under side: volutions three or four, very slightly convex above, nearly flat beneath, and compressed, almost angulated at the periphery above the middle of the shell. The whorls can scarcely be described as embracing, inasmuch as the under surface is wholly exposed, although the upper surface is partly concealed by the succeeding whorl; the inner margin is bent, rather abruptly, towards the apex, and presents a conspicuous angle, which runs round the cavity. The aperture is oblique, but not much so, and subtrigonal, having the lower margin rounded.

This species somewhat resembles *P. elegans*; but it is smaller and more compressed, and the subangulated periphery and flatness of the whorls impart a triangular form to the aperture very different from the roundish, heart-shaped aperture of that species. In *P. biangulatus*, the whorls are more convex, and the aperture is consequently almost obcordate.

Size.—Diameter, 1-10th of an inch nearly.

Localities.—Hordwell; Plumstead; Sundridge; Rotherhithe.

NO. 60. *PLANORBIS ELEGANS*. *F. E. Edwards*. Tab. XV, fig. 12 *a—d*.

P. testá minutá, politá, superne profundè cavatá, subtus parum cavatá; quater vel quinques circumvolutá, anfractibus lineis incrementi notatis, ad peripheriam rotundatis; supra convexis, ad marginem sinistram angulatis; infra convexiusculis; singulo fere trientem antecedentis obtegenti: aperturá parum obliquá, obcordatá.

This very elegant little *Planorbis* is found in great abundance on Headdon Hill, in a deposit immediately above the upper fluvio-marine formation, associated with *Bolimus politus*, *Melanopsis carinatus*, *Melanopsis buccinoidea*, a species of *Neritina*, as yet undescribed, and *Melania muricata*. It is a small polished shell, deeply but not widely hollowed out on the upper disc, and slightly concave, almost flat, beneath: volutions four or five, rounded on the periphery, marked by conspicuous lines of growth nearly perpendicular to the axis, very convex, and presenting a sharpish angle running round the inner margin, on the upper surface, and but slightly convex beneath; each volution embraces nearly a third of the one preceding it. The aperture is of a roundish heart shape, and very slightly oblique.

Size.—Diameter, 3-20ths of an inch.

Localities.—The deposit in which this *Planorbis* principally occurs is a transition bed between the upper fluvio-marine and the pure fresh-water formations in Headdon Hill. I have also found it, but very sparingly, in the upper fluvio-marine formation at Hordwell, and in the lower fluvio-marine or transition bed which intercalates the upper series of the true marine and the lower fresh-water formations at Mead End.

No. 61. *PLANORBIS BIANGULATUS*. *F. E. Edwards*. Tab. XV, fig. 13 *a—d*.

P. testá parvâ, compressiusculâ, utrinque parum, sed fere equaliter cavatâ: anfractibus quinis, singulo antecedentem paucillulo involventi; supra convexis, ad marginem sinistram angulatis; subtus convexiusculis, ad marginem externam obscure crenulatis: aperturâ irregulariter obcordatâ, vix obliquâ.

A small, somewhat depressed shell, slightly and nearly equally hollowed out on both sides, but rather more so above than beneath. It is formed of four or five volutions, convex on the upper side, and obtusely angulated round the cavity in consequence of the somewhat abrupt inflection of the inner margin toward the preceding volution; nearly flat on the under side, and obscurely crenulated near the outer margin. The periphery presents two angles; one, rather obscure, near the middle; the other, more prominent, runs round the margin of the lower disc. The aperture is slightly oblique, and of a short heart shape, but irregular in its form, owing to the greater convexity and the angulated inner margin of the upper surface of the whorl.

This appears to be a well-marked species; the double angle on the periphery and the crenulated under surface are characters which are not found in any other of the Eocene species.

Size.—Diameter, 2-10ths of an inch.

Localities.—Hordwell, as well in the pure fresh-water, as in the upper fluvio-marine formation; and at Mead End, in the lower fluvio-marine or transition bed before mentioned.

No. 62. *PLANORBIS SOWERBYI*. *Bronn*. Tab. XV, fig. 9 *a—d*.

PLANORBIS SOWERBYI. *Bronn*. 1838. *Lethæa geognost.*, p. 1011, t. xl, fig. 17 *a—c*.

P. testâ parvâ, depressâ, utrinque parum et fere equaliter cavatâ: anfractibus ternis vel quaternis, rapidè crescentibus; supra convexis, infra subplanis, ad peripheriam carinatis, singulo dimidium antecedentis obtegenti, carinâ inferiori; aperturâ elongato-cordatâ, per-obliquâ.

The present species appears to be rare. It is a small depressed shell, slightly and nearly equally hollowed out on both surfaces; but the umbilical cavity is the wider and deeper of the two. The volutions are three or four, enlarging rapidly, convex above, nearly flat beneath, and bearing a sharpish keel on the periphery, formed by the compression of the outer margins, a little below the middle of the shell. The whorls are much concealed, each embracing nearly half of the preceding one, and the aperture is very oblique, and of an elongated heart shape.

This shell appears to me, as I have already stated, to have been mistaken by M. Bronn for that described by Mr. Sowerby as *P. lens*, and to have been correctly

referred to a distinct species. It certainly presents a general resemblance to *P. lens*; but the upper side is more arched, the under side flatter, the whorls enlarge more rapidly, and the margins are more compressed and more acutely carinated than in that species; the umbilical cavity, also, is not so deep, and the aperture is of a more oblique and of a more elongated heart shape.

In the rapidly increasing size of the whorls and the condition of the marginal keel, the present species presents an analogy with the recent *P. excavatus* (Gould); but in the latter shell, the upper sides of the whorls are not concealed, the under sides are more convex, the umbilical cavity is deeper, and the aperture is almost obcordate. In *P. tropis* the shell is more compressed, the whorls enlarge more slowly, and the umbilical cavity is wider.

Size.—Diameter, 2-10ths of an inch.

Locality.—Sconce.

PLANORBIS CYLINDRICUS.—Mr. Sowerby has described a shell under this specific name, (Min. Conch., vol. ii, p. 90, t. 140, fig. 2,) the distinguishing characters of which are the vertically flattened, adpressed volutions, concentrically striated on the under surfaces, and the oblong quadrangular aperture. I have not met with any specimen which presents these characters; and as the original specimen, unfortunately, has been broken, I cannot give any description or figure of the species. It is not improbable that the shell described by Mr. Sowerby was a fragment, consisting of the early volutions of one of the larger species I have described, possibly of *P. rotundatus*, in which the whorls, in the young state, are somewhat adpressed and the aperture is subquadrate.

Genus 14th. **ANCYLUS**.* *Geoffroy*.

ANCYLUS, *Geoffroy*, 1767; *Müller*, 1774; *Draparnaud*, 1805; *De Roissy*, 1805; *Férussac*, 1819; *Lamarck*, 1820; *Blainville*, 1825; *Guilding*, 1821.

PATELLA (spec.), *Linnaeus*, *Bruguère*, *Montagu*.

HELICION (spec.), *Montfort*, 1810.

ANSULUS vel **ANSYLUS**, *Gray*, 1840.

Gen. Char.—Patelliform, thin, obliquely conical, sinistral; apex rather pointed, compressed, not lengthened nor spiral, turned sidewise towards the right margin and backwards, not marginal: aperture oval or oblong, margins simple.

This genus, first withdrawn by Geoffroy from the *Patellæ*, was rejected both by Linnaeus and Bruguère, but was revived by Draparnaud, and placed near the *Limnæidæ*, on account of the similarity between the animal and those of *Limnæa* and *Planorbis*. Férussac, who had noticed the occasional ascent of the animal to the surface of the

* Etym. Ἀγκύλος, crooked, twisted.

water, and assumed that this was for respiration, also placed the genus among the aquatic Pulmonata. On the other hand, Lamarek and Blainville, although they adopted the genus, retained it, provisionally, the former among the *Calyptracea*, the latter among the *Scutibranchia*. Subsequently, the Rev. Mr. Guilding, in his 'Zoology of the Caribbean Islands,'* gave the generic characters of the animal, and described the respiratory apparatus as consisting of a small branchial plume placed on the left side, near the excretory orifice; and M. Deshayes, misled by this description, has, in the 2d edition of Lamarek's 'Histoire Naturelle,' rejected the supposition of the animal being a pulmonated mollusc. The more recent observations of the Rev. G. M. Berkeley† have shown, however, that the animal, in its organs of respiration, resembles those forming the present order, and that it is, in fact, a true pulmonated mollusc. The respiratory orifice is protected by a valvular enlargement of the margin of the mantle, which, it is conjectured, was mistaken by Mr. Guilding for a branchial plume. The genus, as originally proposed, embraced as well dextral as sinistral species. The dextral species have been withdrawn by Mr. Gray, under the generic name *Velletia*, (*Aerolorus*, Beck;) a division the necessity for which has been questioned, but which, for the reasons stated under the genus *Velletia*, I have adopted, and the present genus is therefore confined to the sinistral species.

The animal is hermaphrodite, but the union of two individuals is necessary for fecundation: the head is furnished with two cylindrical or triangular retractile tentacles, oculated at their bases; the foot is short, and attached to the abdominal mass, and the mantle is large and free, with a simple continuous margin. The living species are not numerous; one only, *A. fluviatilis*, is found in this country and in central and southern Europe; the rest occur principally in central America. They live in fresh-water, preferring gentle streams.

Four fossil species have been described and referred to this genus, all from the Eocene formations, viz. *A. elegans* (Sow.), from Hordwell; *A. depressus* (Desh.), from the neighbourhood of Versailles; *A. perditus* (Desmar.), from the fresh-water limestone of Ulm; and *A. compressus* (Nyst.), from the neighbourhood of Antwerp. The first two are *Velletia*; the descriptions and figures of the last two are insufficient for determining to which genus they belong.

No. 63. *ANCYLUS?* *LATUS*. *F. E. Edwards*. Tab. XIV, fig. 15 *a-b*.

A. testá conoideá, depressá, latá; vertice submediano: aperturá oblongá, obovatá.

The imperfect state of the only specimen I possess, prevents my doing much more than to record the occurrence of this shell, which I refer to the present genus with hesitation. It is distorted at the posterior extremity, and presents the appearance of

* 'Zoological Journal,' vol. iii, p. 535.

† Ibid., vol. v.

a sinus somewhat resembling that in the shells of the *Limacina*, but greatly exaggerated; this, most probably, is due to the accident which produced the distortion, or to some cause similar to that to which Mr. Gray attributes the sinus in Michaud's *A. sinuosus*. The shell also is thicker than is usual in this genus; but the shelly matter has been absorbed and replaced by carbonate of lime, and a slight thickening may have taken place in that process. It may be described as sub-conical, and much depressed, with the vertex about half way between the margin and the middle; the aperture is oblong and widely obovate. In the great depression of the shell this species resembles *A. (Velletia) depressus*, Desh.; but the aperture is more equally rounded at the extremities.

Size.—Length about $\frac{1}{4}$ of an inch; width, about 2-10ths.

Locality.—Sconce.

Genus 15th. VELLETTIA.* Gray.

ACROLOXUS, Beck, 1837.

VELLETTIA, Gray, 1840.

Gen. Char.—Dextral, with the apex turned sidewise towards the left margin; in all other respects resembling *Ancylus*.

The dextral forms referred to *Ancylus* were first withdrawn by Beck, under the generic name *Acroloxus*, but without any description; the genus was afterwards defined by Mr. Gray under that of *Velletia*. The animal, so far as its organisation is known, as well as the shell, resembles *Ancylus*, except that it is dextral and not sinistral; and the genus has not been received without question, inasmuch as, apparently, it depended on a character insufficient in itself for generic distinction. Mr. W. Thompson, however, in his 'Remarks on the dentition of British Pulmonifera,' to which I have before referred, states that, in their dentition, "*Ancylus* and *Velletia* present widely distinct characters, clearly showing that they do not belong to one genus. In *Ancylus* there are thirty similar lateral teeth in a straight line on each side of the central tooth, and then there is a slight curve through a series of six more teeth, where a trifling change in their form occurs. In *Velletia*, on the contrary, no part of the horizontal row is straight; its central part is much arched, and is composed of the central tooth and twelve lateral teeth on each side, which do not alter much in form. Then comes one tooth of a different form, and lastly, six more on each side, which latter are in a slight curve." A closer examination of the comparative anatomy of the two animals will probably afford additional reasons for the separation of the present genus; in the meantime, I have retained it on the ground of the different characters of the dental apparatus recorded by Mr. Thompson.

The living species are very few: one, *V. lacustris*, is found in this country; the

* A name without signification, used by Mr. Gray on the principle advocated by Fabricius.

others occur principally in the West Indies and South America. The two species before mentioned, *V. elegans* (Sow.), and *V. depressa* (Desh.), are, I believe, the only fossil species hitherto described.

No. 64. *VELLETIA ELEGANS*. *Sowerby*. Tab. XIV, fig. 2 *a—d*.

ANCYLUS ELEGANS. *Sow.* 1826. *Min. Con.*, vol. vi, p. 64, t. 533.

— — *Lyell and Murch.* 1829. *Sur les dépôts, &c. du Cantal.*

— — *Bouillet.* 1836. *Cat. des coq. foss. de l'Auvergne.*

A. testá convexá, subconicá, radiatim subtilissime striatá; vertice obliquo, excentrico, sub-marginali: aperturá longitudinali, ob-ovali.

This elegant shell, for the discovery of which we are indebted to Sir Charles Lyell, is convex and subconical, with an oblique excentric vertex, placed near the posterior extremity. The surface, under a high magnifying power, presents exceedingly fine striæ, radiating from the vertex towards the margin; the mucro is frequently eroded. The aperture is longitudinal and obovate, the wider part being the anterior extremity.

The shell, in this species, is not so oblong and compressed as in the recent *V. lucustris*, and the vertex is nearer the margin. In the French species, *V. depressa*, (Desh.) the shell is more depressed, the anterior extremity is wider, the posterior extremity is narrower, and the vertex is more nearly central.

Size.—Elevation rather more than 1-20th of an inch; length rather more than 3-20ths; greatest width 2-20ths.

Localities.—Hordwell. *French*: Veours in the Cantal.

Family—AURICULIDÆ.

Genus 16th. MELAMPUS. *Montfort*.

VOLUTA, (sp.,) *Linn.*

MELAMPUS, *Montf.*, 1810; *Beck*, 1837; *Gray*, 1840.

CONOVULUS, *Lam.*, 1812; *Cuvier*, 1817; *Beck*, 1837.

AURICULA, (sp.,) *Lam.*

ALEXIA, *Leach*, 1819

CONOVULA, *Féruss.*, 1819.

PEDIPES, (sec. C.,) *Blainville*, 1825.

MELAMPUS, *Lowe*, 1832.

CONOVULUM, *G. Sowerby, jun.*, 1841.

RHODOSTOMA and MELAMPUS, *Swain*, 1840.

Gen. Char.—Shell oval or elongate, sub-cylindrical; generally smooth, and with a short conoidal spire: aperture rather long and narrow; peritreme continuous, with two

or three folds upon the columella; outer lip sometimes simple and sharp, sometimes thickened, and occasionally denticulated within.

The genus *Auricula*, as described by Lamarck, was confined to land shells; and that of *Conorulus*, proposed by him for certain shells which he considered to be fluviatile, he afterwards suppressed under the impression that they also were land shells. The animals which have been referred to the genus *Auricula* have, however, various habitats: some are terrestrial; others live in ponds or fresh-water marshes; and others, again, are inhabitants of the sea, or are found in brackish water near the mouths of rivers, or in salt-water marshes. Some of these groups are distinguished by peculiarities in the animals or their shells; and they, accordingly have been withdrawn from *Auricula* as distinct genera. The present genus, which corresponds with Lamarck's *Conorulus*, was first separated by Montfort for a shell from the shores of Cayenne. The animal resembles that of *Limnæa*; the head is probosciform, notched in front, and furnished with two filiform contractile tentacles, slightly annulated, and oculated at their inner bases; the foot is obovate and obtuse before and behind; the mantle united to the neck, with the exception of a perforation at the junction of the outer and inner lips. The *Melampodes* are strictly marine animals, although they are frequently found in brackish waters near the mouths of rivers or salt-water marshes; they are capable of living out of water for a long period, and Mr. Lowe, in fact, characterises them as amphibious.

The living species are not numerous; three are inhabitants of our own shores; the others are found principally in warm climates. The fossil species hitherto described are from the Eocene and later formations, and have for the most part been referred to *Auricula*.

The peculiarity, observed by Montagu in *Auricula denticulata*, of the columella not extending further than the upper part of the body whorl, is stated by Mr. Gray to be common to most species in the family; and to be caused generally by the animal absorbing the septa which separate the upper whorls, and thus converting the spire into a single cavity, as it enlarges the shell at the edges of the aperture.

NO. 65. MELAMPUS TRIDENTATUS. *F. E. Edwards. Tab. X, fig. 4 a—b.*

M. testá ovato-ventricosá, crassá, leví; spirá conico-depressá, apice obtusiusculo; anfractibus sex vel septem, sub-cylindræis, superne depressiusculis: aperturá auriformi, angustá, labro interne incrassato, antice reflexo: columellá marginatá, tridentatá.

A thick, smooth, ovate, ventricose shell, with a short conical spire and a bluntish apex; volutions six or seven, sub-cylindrical, and somewhat depressed round the suture; the aperture long, narrow, and ear-shaped; the outer lip rather enlarged and inflected in front, and thickened internally, presenting an elevated sharpish ridge, which extends from a little above the middle of the whorl to the columellar lip. The colu-

mella is furnished with three distinct folds, of which the middle one is the largest and the posterior one the smallest; the outer lip is slightly reflected, but not so as to cover the umbilicus.

This species, in its general form, much resembles *C. pyramidalis* (Sow.), but the whorls are not so convex, and the sutures are nearer to each other, so that the spire is shorter and the aperture longer and narrower. The columella also presents three folds, instead of the two which distinguish the crag species.

The shell figured is, I believe, unique; it is one of the many valuable additions made to our Eocene fauna by the "English Natural History Society," under the able direction of Mr. Charlesworth. It forms part of the collection in the Museum of the Philosophical Society of York, who have kindly allowed me the use of it for description.

Size.—Axis, 7-10ths of an inch nearly.

Locality.—High Cliff, Hampshire.

Genus 17th. PEDIPES.* *Adanson*.

PEDIPES, *Adanson*, 1757.

— *Féruss.*, 1819; *Menke*, 1828; *Desh.*, 1832; *Beck*, 1837; *Bronn*, 1838; *Gray*, 1839; *Swain.*, 1840; *G. Sow., jun.*, 1842; *Desh.*, 1843.

— (sec. B), *Blainville*, 1825.

POLYDONTA (sp.), *Fischer*.

BULIMUS (sp.), *Bruguière*.

TORNATELLA (sp.), *Lamarck*.

AURICULA (sp.), *Reeve*.

Gen. Char..—Shell small, thick, sub-globose or oval; spire pointed, not much elevated: aperture sub-ovate or linear; outer lip thin, sharp, with one or two folds within; columella with two folds; one large fold on the penultimate whorl.

This genus was proposed by Adanson on a small marine shell from the coast of Senegal; and, although it was confounded by Bruguière with *Bulimus*, and by Lamarck with *Tornatella*, it appears to have been generally adopted. The animal, which Adanson describes as very small in comparison with the shell, is furnished with two filiform tentacles, oculated at their inner bases; the muzzle is rounded and notched in front; as in *Melampus* and *Limnæa*; the foot is elliptical and divided into lobes separated by a deep transverse furrow; the anterior lobe is transverse, wider than long, and rounded in front; the posterior one longer than wide, and somewhat narrowed

* Etym. Adanson gave the name *Pietin* (quasi *pieton*, a walker,) to this genus on account of the singular way in which the animal walks, and the Latin name, *Pedipes*, imposed by him, has probably reference to this peculiarity.

behind. The mode of progression, as described by Adanson, is as follows: the animal, having attached itself by the posterior lobe, protrudes the anterior lobe as far as the hollow part of the foot, which is capable of considerable extension, will permit; and the posterior lobe is then advanced until it touches the anterior one. This movement, quickly repeated, enables the animal to advance with a rapidity apparently disproportioned to its size. Adanson states that, on the animal emerging from or withdrawing into the shell, the lobes pass one on each side of the large posterior fold, which, being continued into the interior of the shell, keeps them constantly separated.

Only three or four living species are known, all from tropical regions. Of fossil species, M. D'Orbigny, in his 'Prodrome de Paléontologie,' cites five, which he refers to this genus, from the Eocene formations in France.

No. 66. *PEDIPIPES GLABER*. *F. E. Edwards*. Tab. X, fig. 9 *a—c*.

P. testá minutá, ovali, ventricosá, glabrá; anfractibus quaternis vel quinis, ad suturam adpressis; spirá mediocri: aperturá semiovali; labro uniplicato, antice intus incrassato: plicá columellari posteriori, angulatá, flexá.

A minute, oval, ventricose and smooth shell; volutions four or five, adpressed at the posterior margins so as to form a narrow band round the suture; the spire moderately elevated: the aperture semioval; the outer lip with a sharp edge, and furnished with a fold placed about the middle, and in front of which the lip is thickened internally; the large columellar fold on the penultimate whorl is angulated and bent so as to present a slight concavity on the anterior surface, and a corresponding convexity on the posterior one.

This exceedingly rare and interesting shell forms part of Mr. D'Urban's valuable collection.

Size.—Axis, 2-20ths of an inch nearly; diameter, rather more than 1.20th.

Locality.—High Cliff.

SUB-ORDER—*PHANEROPNEUMONA* (Gray), *OPERCULATA*, (Férussac.)

Family—CYCLOSTOMIDÆ.

Genus 18th. *CYCLOTUS*.* *Guilding*.

CYCLOTUS, *Guild.*, 1840, (fide *Swainson*.)

POTERIA, *Gray*, 1840.

APEROSTOMA, *Troschel, Pfeiffer*, 1847.

CYCLOTUS, *Gray*, 1850.

* Etym., *κυκλωτος*, rounded.

Gen. Char.—Spire sub-turbinate, depressed, or discoidal; apex obtuse; whorls rounded: aperture nearly circular, with a small siphon at the posterior extremity; peristome simple, sometimes reflected; widely umbilicate: operculum thick, calcareous, formed of two laminæ with a groove on the edge between them; outer surface rather concave; whorls numerous, enlarging gradually, with the outer edge reflected, forming a spiral fringe.

The genus *Cyclostoma*, as originally proposed by Lamarck, rested entirely on the circular form of the aperture, a character which applied as well to land as to marine and fresh-water species, and brought together animals essentially different, not only in their organisation, but in the structure of their shells. From this heterogeneous group, Draparnaud withdrew the marine species, and restricted the genus to the land and fresh-water species; and Lamarck afterwards formed for the marine and fresh-water species the genera *Scalaria*, *Delphinula*, *Paludina* and *Valvata*, and confined the genus to the free-air breathing land species. The animal is unisexual and operculated, with a proboscidiform head, furnished with two subulate annulated tentacles, oculated at their external bases; the respiratory opening, unlike that of the preceding sub-order, is largely open in front, resembling that of many of the branchiated molluscs. These characters separate the genus and its sub-genera as a distinct group among the pulmonated molluscs. The modification of the organs of respiration, to which many zoologists have attached great importance, has been considered by others as a character of comparatively small value; and the resemblance which the animal of *Cyclostoma* presents to that of *Turbo*, in many important particulars, induced Cuvier to disregard the peculiarity of the respiratory apparatus, and to place the genus in the same family as *Turbo*; and M. Deshayes* has suggested that the *Cyclostomidæ* should form a distinct group near to or among the *Turbinacea*. Such an arrangement, however, cannot consistently be adopted in any system in which the mode of respiration is admitted as an ordinal character; and consequently the *Cyclostomidæ* are retained, almost universally, among the pulmonated molluscs.

As ultimately restricted by Lamarck, the genus *Cyclostoma* comprised two groups, which presented distinct forms of the operculum; that appendage being formed, in one group, of a few rapidly enlarging whorls, and, in the other, of numerous slowly increasing whorls. Each of these groups comprised species in some of which the shells were more or less widely umbilicated, and in others imperforate, or nearly so. Montfort availed himself of the condition of the umbilicus, a character in itself of little generic value, and separated the widely umbilicated species under the generic name *Cyclophorus*, retaining the imperforate species for his genus *Cyclostomus*; but the characters presented by the opercula were altogether overlooked or disregarded. Each genus, therefore, comprised species presenting different forms of operculum;

* Lam. Hist. naturelle, 2d edit., vol. viii, p. 351.

and numerous genera and sub-genera have, in consequence, been withdrawn by Gray, Guilding, Troschel, Pfeiffer, and others, on characters taken principally from modifications of the operculum. The present genus was separated by Mr. Guilding, from *Cyclophorus*, for some shells from the West Indies; it is distinguished by the thick calcareous operculum, formed of two distinct layers. The animal, so far as it is known, resembles that of *Cyclostoma*.

The recent species are not very numerous. Mr. Gray, in his Nomenclature of Molluscous Animals, &c., in the British Museum, part "Cyclophoridae," gives a list of twenty-eight species, all of which are from the West Indian Islands, or from Central or South America.

No. 67. *CYCLOTUS CINCTUS*. F. E. Edwards. Tab. X, fig. 1 *a—c*.

C. testá conico-depressá, lineis tenuibus spiraliter cinctá; anfractibus quinque vel sex, rotundatis, ultimo paullo decurrenti: umbilico magno; aperturá sub-circulari.

This remarkably elegant shell is conical and somewhat depressed, formed of five or six rounded whorls, and ornamented with numerous, irregular, rather sharp, spiral, raised lines, some of which are more elevated than the rest; these lines are spread over the whole surface of the shell; but they are more crowded on the upper than on the under surface, and are very prominent in the umbilicus, where they are sometimes strongly decussated by the lines of growth. The last whorl is slightly decurrent; the aperture is nearly round, with the peristome a little reflected, but not much so; and the umbilicus is very wide, being nearly one third of the diameter of the shell.

Two or three detached opercula have been obtained by Mr. D'Urban, which present all the leading characters of the opercula of the living species; but, as yet, it cannot be determined to which of the two fossil species they belong. They are thick, testaceous, slightly concave externally, formed of five or six slowly enlarging whorls with the external fringe deeply grooved. One of them is represented by fig. 12 *a—b*, Tab. X.

This species has hitherto been found only at Sconce, where it occurs rather plentifully; but specimens with the shell preserved are rare.

Size.—Axis, 5-10ths of an inch; diameter, rather more than 6-10ths of an inch.

No. 68. *CYCLOTUS NUDUS*. F. E. Edwards. Tab. X, fig. 11 *a—b*.

C. testá ovato-conicá, lavi; spirá mediocri; anfractibus quinque convexis: aperturá rotundatá, umbilico parvo.

A smooth ovately-conical shell, with a moderately elevated spire, formed of five convex volutions: aperture nearly circular; umbilicus narrow but deep.

The surface of the shell in this species is perfectly devoid of ornament, a character

which at once separates it from the preceding species; the casts, in which state specimens are most commonly found, may be distinguished by the more elevated spire, the less effuse base, and the narrower umbilicus.

Size.—Axis, half an inch; diameter, nearly the same.

Locality.—Sconce, where, although it is not by any means rare, it is not so common as *C. cinctus*.

Genus 19th. CRASPEDOPOMA.* *Pfeiffer*.

CRASPEDOPOMA, *Pfeiff.*, 1847.

VALVATA (sp.), *Menke*.

BOLANIA, *Gray*, 1842.

Gen. Char.—Shell sub-turbinate; last whorl slightly produced, straight, attenuated towards the aperture, which is circular: peristome continuous, simple, slightly thickened; axis imperforate or narrowly umbilicate.

This is one of the genera, separated by Pfeiffer, (*Zeitsch. für Malak.*) depending principally on the characters presented by the operculum. That appendage in the present genus differs from the operculum of *Cyclotus*, in being horny instead of calcareous; and in having, on the outer edge of the internal disc, a circular prominence which overlaps the margin of the aperture; the external disc is also flat, and not concave, as in *Cyclotus*. The shell is distinguished by the attenuation of the last whorl, which gives a contracted appearance to the aperture, a character not found in any other group of the *Cyclostomidae*. Only two living species are known; both are from Madeira.

No. 69. CRASPEDOPOMA ELIZABETHÆ. *F. E. Edwards*. Tab. XIV, fig. 14a—c.

C. testá parvá, conicá, perforatá; lineis spiralibus, numerosis, tenuissimis, ornatá; apice obtusiusculo: anfractibus quinis, rotundatis, ultimo decurrenti: aperturá circulari, intus incrassatá; umbilico angusto.

A small trochiform shell, ornamented with numerous fine, spiral, raised lines, and formed of four or five rounded volutions, the last of which is attenuated towards the aperture and slightly decurrent; the spire is moderately elevated, with a somewhat blunt apex: the aperture is nearly circular, and slightly thickened internally; the umbilicus is narrow.

Without the assistance to be derived from the operculum, it is scarcely possible to determine correctly to what genus the present shell should be referred. It has much the appearance of a *Valvata*; but the thickened peristome indicates its affinity to the

* Etym., κράσπεδον, a rim or border; πωμα, a lid, (the operculum.)

Cyclostomidæ, and the attenuation of the last whorl induces me to place it in the present genus, apparently the only one in the family to which that character belongs. I refer it, however, to *Craspedopoma* provisionally only, until, by the acquisition of more perfect specimens, its true position may be ascertained.

This elegant shell was discovered by Mr. D'Urban and myself, on a recent visit to the Isle of Wight, accompanied by Miss D'Urban, to whom, in commemoration, I have ventured to dedicate it. It is apparently very rare, and although we procured several specimens, not one had the shell preserved.

Size.—Axis, 4-20ths of an inch; diameter, 3-20ths nearly.

Locality.—Sconce.

HELICINA.—The shell described by Lamarck as *Helicina dubia* is found in the High Cliff sands, and at Barton; it is, however, a *Rotella*, and will be described in its proper place.

In order that this account of our Eocene pulmonated molluscs may contain all the species at present known, I subjoin the description of a shell acquired by me since the early part of this monograph was printed, and which I have referred to *Bulimus*, although the aperture is of a form unusual in that genus.

No. 70. BULIMUS HETEROSTOMUS. F. E. Edwards. Tab. XIV, fig. 1 a—d.

B. testá parvâ, conicâ; spirâ elevatâ, acutiusculâ, apice deciduo; anfractibus septenis vel octonis, rotundatis, transversim regulariter lineatis; lineis tenuissimis, numerosis, perobliquis: aperturâ rotundo-ovatâ, peristomate reflexo.

This shell has so much of the character and appearance of *Truncatella*, that I should be inclined to refer it to that genus; but it is found associated with land and true fresh-water shells only, in a formation which does not present any trace of marine origin. The nearly circular aperture resembles that of *Cyclostoma*; the transverse lincation, however, is a character which, I believe, is not ever found in that genus. I have referred it to *Bulimus*, but with some hesitation. It is a small conical shell, with an elevated, tapering, pointed, spire, the apex of which is subject to decollation; the seven or eight whorls of which it is formed, are rounded, separated by a deep suture, and ornamented with fine transverse raised lines, which are numerous, regular, and very oblique; the aperture is roundedly ovate, apparently thickened within, and with

the margin slightly reflected. In specimens which have not attained the full size, the bases of the whorls are flattened and sharply angulated at the outer margins.

This species appears to be well characterised; it is separated by the striation and the form of the aperture, from the several small fossil species described by Lamarck and by Deshayes.

Size.—Axis 3-10ths of an inch; diameter not quite 3-20ths.

Localities.—Sconce and Headon Hill; apparently, it is very rare.

I cannot close the present Monograph without noticing certain oviform substances which occur, rather plentifully, in the fresh-water formation at Sconce, as to the nature and origin of which various opinions have been entertained. I have been fortunate enough, however, to obtain lately, specimens which appear to me to remove all doubt on the subject, and to show conclusively that these substances are, in fact, the remains of the eggs of some animal. The condition in which they most usually occur, is that of casts formed of the same material as the rock in which they are imbedded; they present great regularity of form, and resemble, in every respect, the internal cast of an egg. Occasionally only a hollow space, the impression of the egg, is found without the internal cast, and without the calcareous covering, which has been wholly absorbed; and sometimes, though more rarely, the covering of the egg itself occurs; but in that case the calcareous matter has always been replaced by carbonate of lime, and in this state the inside is sometimes empty—sometimes it is filled with the matrix. The absorption of the calcareous matter, and its occasional replacement by carbonate of lime, are the conditions in which, as we have already seen, the testaceous remains of Mollusca imbedded in the same formation are frequently found. The hypothesis that these substances are the casts or remains of eggs, appears to me to be the only one by which the different states in which they are found can be satisfactorily explained. Where the egg has been broken, the cavity of the shell has been filled by the fluid matrix, and the internal cast is formed. The eggs may, in some instances, have been broken accidentally; but they appear almost universally to have been broken by the young animal on effecting its escape; for one end of the casts is free, smooth, and regular in form; while the other end, apparently broken by the animal, is irregular and connected with the external matrix. If, on the other hand, the egg has been imbedded unbroken, only the cavity formed by it in the matrix remains; or if the covering of the egg is found, it is either quite empty, or small globules of the carbonate of lime, by which the shell has been replaced, are found attached to the sides. I assume therefore that the substances in question are the remains of eggs, but of what animals it is more difficult to determine. They are of different sizes, varying in length from 2-10ths of an inch to nearly two inches; in shape they are oval, rounded equally at both

extremities, and although they are generally regular in form, as I have already stated, yet specimens occasionally occur more nearly spherical. The substance forming these casts is most frequently close and compact, like the rock in which they are embedded; sometimes, although rarely, the cavity is partially filled with matter, apparently the same as the matrix, but more granular, and sometimes crystalline, as if due to percolation.

I am aware that by some these substances are regarded as coprolitic;* that by others they are considered to be the remains of seed vessels; and, again, that by others their origin is attributed to the cocoons of insects; and I am desirous that the opinion I have expressed should be received as a *suggestion*, rather than as an induction from evidence which, it must be admitted, is inconclusive. As bearing, however, on the subject, and, if not supporting the view I have taken, at least presenting in some respects an analogy with the substances in question, I may refer to the instance of the eggs of turtles found on the shore of the Isle of Ascension, embedded in a recent limestone formed of sand, comminuted shells, and corals agglutinated together.† A small mass of this rock, enclosing several eggs, is in the Museum of the Geological Society of London; the cavities of the eggs are filled with the material forming the matrix, and, although the calcareous shell remains, we have only to imagine the eggs embedded under circumstances which would cause the dissolution and absorption of the calcareous matter, and some of the very conditions in which the substances in question are found would be exactly represented.

A series of these substances, showing the different sizes and forms, is represented by the woodcuts in the next page. Those most commonly found are represented by figs. 2, 3, 4, and 5; they present a close resemblance, both in size and shape, to the eggs of several of the recent fresh-water tortoises, and may be casts of eggs of some of the species of *Trionyx* or *Emys*, which lived in the Eocene rivers or marshes. Those represented by figs 8, 9, and 10, may be casts of some of the *Helicidae*.

* With regard to the suggestion that these substances are coprolitic, it must be stated that the casts, some of which have been subjected by Mr. Morris to chemical analysis, do not present any trace of phosphate of lime; the presumption, therefore, is against their being coprolites of a carnivorous animal, and the constant regularity of their form, and the absence of carbonaceous matter, militate as strongly against the idea that they are fecal remains of an herbivorous animal.

† Lyell's 'Principles of Geology,' 9th edit., p. 77. Ansted's 'Geology,' vol. ii, p. 137.



- Fig. 1—10. Oviform substances of the different sizes found in the fresh-water limestone at Sconce, in the Isle of Wight.
- „ 11. An oviform embedded entire, in which the outer covering has been absorbed and replaced by carbonate of lime; the cavity empty.
- „ 12. An oviform in a condition similar to No. 11, excepting that the cavity is partly filled with crystals of carbonate of lime.
- „ 13. The impression left in the matrix by an oviform embedded entire, the outer covering of which has been absorbed.
- „ 14. The internal cast of an oviform of which the outer covering has been absorbed.

ORDER—*PROSOBRANCHIATA*. M. EDWARDS.PECTINIBRANCHIATA, *Cuvier*.

TUBULIBRANCHIATA, „

SCUTIBRANCHIATA, „

CYCLOBRANCHIATA, „

PARACEPHALOPHORA DIOICA, *De Blainville*.

To the free-air-breathing gasteropods succeed those which breathe, by means of gills, the air diffused through the water in which they live. In them the head is more or less fully developed, and the mouth is furnished with a riband-shaped tongue, armed with numerous series of teeth, which present great varieties of form and arrangement. In some cases the animals are hermaphrodite, the sexes being united in the same individual, but in by far the larger proportion the sexes are distinct; with very few exceptions, they are all oviparous. In the larva state they are always furnished with spiral shells, which, in some cases, as the animals approach maturity, become rudimentary or altogether disappear; but more generally the shells become largely developed, so as to contain the whole animals within them. The respiratory organs exhibit many differences in structure and position, and these varied conditions were adopted by Cuvier as ordinal distinctions in the systematic arrangement proposed by him. De Blainville, on the other hand, availed himself of the modifications in the reproductive apparatus, and divided his second class "*paracephalophora*," into the sub-classes *dioica*, in which the male and female sexual organs are in different individuals, and *monoica*, in which the two sexes are united in the same individual. To these he added a third division, *hermaphrodita*, in which he described the generative apparatus as female only, a modification the existence of which subsequent investigation has disproved. It appears, however, by the observations of Milne Edwards, that the water-breathing gasteropods form two natural and well-defined divisions, which that eminent naturalist has called respectively, *opisthobranchiata* and *prosobranchiata*, from the position of the gills in relation to the heart.* In the first of these divisions, which corresponds with the *nudibranchiata*, *testibranchiata*, and *inferobranchiata* of Cuvier, and with the *monoica* and *hermaphrodita* of De Blainville, the respiration is effected by

* Etym. *οπισθε* (in the after part, behind), and *προῶσον* vel *πρῶσον* (advanced, pushed forward), respectively prefixed to *βραγχια* (the gills).

arborescent or fasciculated gills, which are not enclosed in a special cavity, but are more or less completely exposed, either on the back or on the sides towards the hinder part of the body. The reproductive apparatus is hermaphrodite (not in the sense used by De Blainville, but meaning that the sexes are united in the same individual), and the shell is either wanting or is merely rudimentary in the adult state. In the second division, the abdomen, which is developed proportionately with the cephalic and locomotive masses, is always protected by a shell, generally of sufficient size to contain the whole animal. The mantle forms over the cervical region a vaulted chamber, more or less capacious, in which the branchiæ are lodged and the excretory orifices are placed. The reproductive organs, male and female, are borne by different individuals. This division comprises Cuvier's four remaining orders of the *branchifera*, and corresponds with De Blainville's sub-class *dioica*. The branchiæ are composed of simple and parallel plates, arranged, somewhat like the teeth of a comb, along a vascular stem, and, for the most part, are placed obliquely across the back, or are attached to the right side of the neck.

In some genera in this order, the edge of the mantle is prolonged into a canal or siphon, which can be extended at pleasure, so as to permit the free passage of water into the branchial chamber, while the animal itself remains within the shell; and where this siphon exists, the front of the aperture of the shell presents a notch, or is produced into a channel in which the siphon rests. In other genera the respiratory siphon is altogether wanting, or its place is supplied by a lobe developed from the neck, and in these genera the aperture is without the anterior notch or channel. Sometimes a posterior tube exists with a corresponding notch or canal in the shell; but the function of this posterior tube is simply to provide for the more easy efflux of water or the ejection of the anal excretions from the branchial chamber. The head of the prosobranchiate gasteropod is provided with tentacles, which serve as organs of touch, and probably of smell, and with a proboscis which in some genera is retractile or exsertile. The eyes, with which organs all are endowed, are generally placed either at the bases, or on the extremities, or the sides of the tentacles; but in some genera they are carried on pedicels specially appropriated for them.

The presence or absence of the respiratory siphon has been used for the subdivision of the present order into two sections: 1st, *Siphonostomata*, corresponding with De Blainville's order *siphonobranchiata*, and comprising such of the prosobranchiata whose proboscis is retractile, and the margin of whose mantle is prolonged into a siphon, and whose shell is, consequently, notched or produced into a channel in front: and 2d, *Holostomata*, consisting of those in which the proboscis is not retractile, and the animal not being provided with a respiratory siphon, the aperture of the shell is entire. The genera comprised in the first section are all zoophagous, and are inhabitants of the sea or of brackish water; those in the 2d section are, for the most part, phytophagous; the greater number live in salt or brackish water; some, however, are inhabitants of fresh

water. This subdivision, although very convenient, is not, as Mr. Woodward* remarks, altogether satisfactory; inasmuch as several genera occur among the *holostomata* in which the proboscis is retractile, or the shells are notched or furnished with an anterior canal.

By far the greater part of the present order are furnished with an operculum, but many are without that protection.

Since Lovén published the result of his examination of the dental apparatus of Mollusca, much attention has been paid to the subject, and great importance is attached to the condition of the lingual teeth. But the assistance derived from this character, however valuable it may prove to malacologists, can be available indirectly only to the palæontologist.

Family—CYPRÆIDÆ.

Genus 20th. CYPRÆA.† *Linn.* 1740.

PERIBOLUS, *Adanson*, 1757; *De Blainville*, 1825.

CYPRÆA, *Lamarck*, 1801; *De Blainville*, 1825.

CYPRÆA, *Montf.*, 1810.

COCCINELLA, *Leach*, 1820.

TRIVIA—CYPROVULA—LUPONIA, *Gray*, 1830.

Gen. Char.—Shell oviform, oblong or sub-globular, convolute, enamelled, generally smooth, sometimes pustulous, transversely ribbed, or cancellated: spire short, depressed visible only in the young state, when adult, concealed by the enamel; aperture long, narrow, terminating at each extremity in a short canal; outer lip inflected, crenulated; inner lip crenulated.

The animal of Cypræa has a broad, sub-lunate head, terminating in a short retractile muzzle, and bearing long subulate tentacles on bulgings, at the outer bases of which the eyes are placed. The foot is broad, truncated in front, pointed, and sometimes much produced behind; the mantle terminates in a siphon in front, and the lateral margins, as the animal approaches maturity, expand into lobes, generally equal, but frequently more or less unequal, and which can be extended at pleasure, so as entirely or nearly to cover the shell, the edges meeting on the back or on the right side, according as the lobes are equal or unequal. By these lobes is deposited the testaceous matter which forms the enamel-like covering of the shell, characteristic of the family; the line of juncture being usually indicated, in recent cowries, by a groove or a streak of a fainter colour. The outer surfaces of the lobes are generally covered

* 'A Manual of the Mollusca,' p. 122.

† Etym., from *Cypris*, one of the names of Venus.

with filaments, sometimes with numerous papillæ, and in some instances they are smooth. The branchial organ consists of a single plume, and the dental apparatus is composed of a series of rows of teeth, each row formed of one broad uncinated central tooth, and three hooked lateral teeth on each side.

In the young state, the Cowry presents a very different appearance to that which it ultimately assumes. In the early stage of growth the outer lip is thin, sharp, and simple, neither involute nor crenulated; the aperture is wide and effuse in front, and the spire is well-marked. In this state the shell is quite smooth, and without the enamel and coloration which subsequently form its chief beauty.

Various generic divisions of the *Cypræa* have been proposed by different authors; but they appear to depend mainly on conchological distinctions, the animals, in so far as they are at present known, not presenting essential differences from the true *Cypræa*; and these genera, therefore, are more usually regarded as sections merely of the present genus. A slight variation in the dental apparatus, and the papillose surface of the lobes appear to distinguish the genus *Trivia*,* the only section of the present genus which is represented in our Eocene Fauna.

As a genus, the living Cowries have a wide range, extending from the shores of Greenland to the equator. The largest and most beautiful species are, however, inhabitants of the tropical seas, where they are found in shallows under coral-reefs or rocks. Upwards of 150 species have been figured and described; of these one species only (*Cyp. Europæa*), is found on our coasts.

In the fossil state, a few species, referred to this genus, from the upper cretaceous formations in Pondicherry, at Martignes (Bas du Rhone), and at Faxø, in Denmark, have been described by Professor E. Forbes, Matheron, and Sir C. Lyell; but in the eocene and subsequent formations, the genus has a much larger development. From the lower and middle beds of the Paris Basin, twelve species have been described by Lamarck, Deshayes, and Melleville; from the miocene and more recent beds of Touraine, Dax, and Bourdeaux, and the pleiocene formations of Piedmont and Turin nearly seventy species have been described by Dujardin, Grateloup, Brocchi, Basterot, Sismonda, and others; and from the Crag of England, and the synchronous deposits in Belgium, several other species have been described by MM. Sowerby, Searles Wood, Nyst, and Philippi. Of the English eocene *Cyprææ*, five species only have hitherto been described; to these I now add four new species, three of which belong to the section *Trivia*.

No. 71. *CYPRÆA INFLATA*. *Lamarck*. Tab. XVI, fig. 4a, b.

CYPRÆA INFLATA, *Burtin*. 1784. *Oryct. de Bruxelles*, t. 17. fig. T.

— — *Lamk*. 1802. *Ann. du Mus.*, vol. ii, p. 389, No. 2, vol. vi, t. 44, fig. 1.

* Messrs. Adams' 'Genera of Recent Moll.,' vol. i, p. 264.

- CYPRÆA INFLATA, *Lamk.* 1822. *Hist. nat.*, vol. vii, p. 407, No. 11.
 — — *Brogn.* 1823. *Sur les terr. tert. &c. du Vicent.* p. 62.
 — — *Defr.* 1826. *Dict. des Sci. nat.*, vol. xliii, p. 35.
 — — *Bronn.* 1831. *Ital. Tertiargeb. &c.*, p. 15, No. 33.
 — — *Gray.* 1832. (*Add. to Mon. Cyp.*). *Zool. Journ.*, vol. iv, p. 76, No. 30.
 — — *Desh.* 1824—37. *Desc. des Coq. foss., &c.*, vol. ii, p. 724; t. 97, figs, 7, 8.
 — — ? *Galeotti.* 1837. *Mém. sur la const. géog. &c. de Brab.*, p. 148, No. 69.
 — OVIFORMIS, ? *Galeotti.* 1837. *Mém. sur la const. géog. &c. de Brab.*, p. 183, No. 12.
 — INFLATA, ? *Nyst.* 1843. *Coq. &c.*, de Belg., p. 607.
 — — *Sowerby.* 1850. *Dixon's Geol. &c. Suss.*, p. 108, t. 8, figs. 4-5.

C. testá ovatá, inflatá, anticè attenuatá, posticè sub-obtusá, lævi: aperturá elongatá, angustá, flexuosá, basi dilatátá, vix emarginatá; columellá obsoletè plicato-dentatá; labro incrassato, extús sub-marginato, intus regulariter dentato, anticè compresso.

Shell ovate, ventricose, swelled out in the middle, attenuated in front, rather obtuse behind, smooth: aperture elongated, curved, narrow, but somewhat wider in front, where it terminates in a short wide canal, obscurely notched. The outer lip much produced, and the posterior extremity bent suddenly towards the apex of the spire, forming between it and the posterior extremity of the body-whorl, an oblique narrow groove, which represents the posterior canal found in some of the Cyprææ; the outer lip thickened, depressed on the surface, flattened in front on the inner surface, where it joins the anterior canal, and presenting a prominent ridge along the outer margin; the teeth, which are short and placed on the inner edge only, become obsolete on the flattened part of the lip. The columella presents four or five oblique folds in front, and is obscurely dentated behind.

This Cypræa occurs rather numerously in the *calcaire grossier*; our English specimens are generally of a larger size than those found in the French formations.

Size.—Axis, 1 inch and 5-10ths, nearly; diameter, 1 inch: occasionally larger specimens occur.

Localities.—Bracklesham Bay, where it is common; but the specimens are generally distorted. *French:* Grignon, Parnes, Mouchy, Amblainville, Thury-sous-Chaumont. (fide D'Orb.) The species is recorded by Brogniart and by Bronn as occurring at Ronca (Vicent.) but the identity is questionable. Casts of Cyprææ occur in the sands of Rouge-Cloître, St. Josse-ten Noode, Groenendael and Orp-le-Grand, in Belgium, which also have been referred, although with doubt, to the present species. The shells from Dax and St. Paul, which were described by Grateloup as belonging to *C. inflata*, appear to belong to a distinct species, which D'Orbigny has named *C. pseudo-inflata*; and the shells from the Piacentin, referred by Brocchi to this species, also appear to be distinct, and have been described by Sismonda under the name *C. labrosa*.

No. 71*. *CYPRÆA OVIFORMIS*. *Sowerby*. Tab. XVI, f. 1a—i.*CYPRÆA OVIFORMIS*, *Sow.* 1812. *Min. Con.*, vol. i, p. 17, t. 4, 3 lower fig.— — *Defr.* 1826. *Dict. des Sci. nat.*, vol. xliii, p. 40.*OVULUM RETUSUM*, *Sow.* 1834. (Wetherellon Hampstead Heath Well,) *Geol. Trans.*, 2d. Series, vol. v, p. 136, t. 8, fig. 19.Non *CYPRÆA OVIFORMIS*, *Galeotti*. 1837. *Mém. sur la const. géog. &c. de Brab.*, p. 183, No. 12.

C. testá sub-globosá, anticè attenuatá, lævi: aperturá posticè elongatá, flexuosá, angustissimá, anticè latiori, extremitatibus canaliculatá, ad basin emarginatá; labro posticè et in medio compresso et incrassato, anticè acuto, expanso, extus marginato, intus regulariter dentato; labio anticè compresso, in callum fastigiosum ad basin tendentem lateraliter expanso; columellá planulatá, anticè concavá, dentato-plicatá.

Shell sub-globose, narrowing gently towards the base, where it is produced into a short wide beak or canal, slightly notched in front, smooth: aperture elongated, curved, very narrow, but expanding a little before it enters the anterior canal; the outer lip prolonged at the posterior extremity, thickened; compressed until nearly opposite the wide part of the aperture, where it becomes thin and elevated, and is flattened on the inner surface; a narrow raised border, more or less prominent in different individuals, runs along the outer margin, and joins the thin elevated part of the lip. The teeth are numerous, short, not extending beyond the inner margin, and almost obsolete on the anterior part of the lip. The inner lip, towards the front, expands into a narrow ridge-like prominence, which extends to the very base; and at the posterior extremity rises into an angular callus, forming the left wall of the posterior canal. The columella is flattened, hollowed towards the front, and covered with numerous slender pliciform teeth.

The projecting margins, imparting to the front of the aperture the resemblance of a wide trough, form a character by no means common among the *Cyprææ*; it is found, although not so prominently, in *C. exerta* (Desh.), a species from the *sables inférieurs* of the Paris Basin, and in the English *C. Bartonensis*. A short and very globose variety (fig. 1d) occurs at Whetstone, in which the projecting margins are farther apart, and the trough, consequently, is wider than in the type. The specimen figured, which is from Mr. Wetherell's collection, has lost part of the anterior canal.

In the young state, this *Cypræa* is almost pyriform, being much more produced and attenuated in front; and it is covered with very numerous transverse raised lines, traversed by sharp, perspicuous lines of growth; the aperture is much lengthened and curved at the posterior extremity, wide, and very effuse in front, and the columella is twisted. In this state it has the appearance of an *Ovula*, and, in fact, an immature individual of the species obtained by Mr. Wetherell, from the well sunk at the Lower Heath, Hampstead, has been described by Mr. Sowerby as *Ovulum retusum*. A selection from the beautiful series of specimens in Mr. Wetherell's cabinet, with the aid of some

specimens in my own collection, enables me to show that the *Ovulum retusum* is, as I have stated, only the young shell of the present species. The shells represented by fig. 1e, 1f, and 1i, are young Cyprææ, in the first stage of growth, without teeth on either lip, and before the outer lip has become involute, but presenting the transverse lineation of the so-called *Ovulum retusum*, fig. 1i, being, in fact, taken from one of the original specimens so described. In the next specimen, fig. 1g, the shell has apparently attained the second or intermediate stage, the columellar teeth having been formed, and the lateral expansion of the left lip having commenced; and we find these characters associated with the transverse lineation. The specimen, fig. 1h, is a fully formed shell of *C. oviformis*, in which, a portion of the shell having been broken away, the interior volutions, exhibiting the transverse lineation, are disclosed.

Size.—Axis, 1 inch and 3-10ths; diameter, 1 inch.

Localities.—Primrose Hill, Highgate, Hampstead, Haverstock Hill, Copenhagen Fields; Bårnet, Whetstone, Potter's Bar, Sheppey.

No. 72. CYPRÆA BOWERBANKII. Sowerby. Tab. XVII, fig. 1a—d.

CYPRÆA OVIFORMIS, Sow. (1812.) Min. Con., vol. i, p. 17; t. 4, upper fig.

— BOWERBANKII, Sow. (1850.) Dixon's Geol. &c., Suss., pp. 108 and 189, t. 8, figs. 1 and 2.

C. testá oviformi, ventricosá, lævi: aperturá angustá, arcuatá, anticè sub-effusá, latè emarginatá; labro inflexo, marginato, posticè producto, anticè compresso, dentato-plicato, dentibus anterioribus elongatis; columellá dentatá, dentibus anticis pliciformibus; denti primá magná, proeminenti, rotundatá.

Shell egg-shaped, ventricose, smooth: aperture curved, narrow, effuse in front, without a posterior canal, and widely but not deeply notched at the base; outer lip incurved, produced posteriorly, flattened towards the front; teeth on the flat part elongated, oblique; the anterior tooth on the columella large, round, prominent, and very oblique.

The specimen represented by fig. 1a and 1b, and for the use of which I am indebted to Mr. Sowerby, is the Highgate shell, from which the upper figure in tab. 4 of 'Mineral Conchology,' was taken; it has not attained maturity, the teeth not being formed on the outer lip. It will be seen that the aperture in fig. 1b is wider in front than that in fig. 1d, which is taken from a fully grown shell: this difference is to be attributed partly to the immature state of the outer lip of the specimen, and partly to the front of the columella being represented with a curve too deep. In other respects the Highgate shell agrees with those from Bracklesham Bay. The figs. 1c and 1d, are taken from specimens which form part of the late Mr. Dixon's collection.

According to the strict rules of nomenclature, the specific name *oviformis* ought, perhaps, to be retained for this shell; but the species which occurs not unfrequently at Highgate and the neighbouring localities, and which is figured on the same plate, is so generally known as *C. oviformis*, that I have applied the name to that species.

Size.—Axis, 3 inches and 1-10th; diameter, 2 inches and 2-10ths.

Localities.—Highgate, where it is very rare; Bracklesham Bay, where it is not uncommon.

No. 73. *CYPRÆA GLOBULARIS*. *F. E. Edwards*. Tab. XVI, fig. 3*a*, *b*.

CYPRÆA GLOBOSA, *J. Sow.* 1850. *Dixon's Geol., &c., Sussex*; p. 189, t. 8, fig. 3.

C. testá globosá, lævi, anticè rostratá, vix emarginatá; aperturá sub-rectá, angustá, posticè sub-canaliculatá; labro inflexo, compresso, intus dentato, dentibus numerosis, ferè equalibus; columellá dentato-plicatá, anticè compressá.

Shell globose, smooth, with a short straight, rather narrow canal; scarcely notched in front; aperture nearly straight, narrow, terminating posteriorly in an obscure canal; outer lip broad, compressed, curved inwards, with numerous regular teeth, nearly equal in size, placed on the inner edge; columella furnished with numerous pliciform teeth.

The nearly globular form and short narrow beak of this exceedingly rare *Cypræa* distinguish it from all its congeners. The specimen from which the figures are taken forms part of Mr. Dixon's collection, and is, I believe, unique. The specific name proposed by Mr. Sowerby having been previously used by Dujardin for a different species from the Faluns of Touraine, I have substituted the present name for it.

Size.—Axis, nearly 2 inches; diameter, $1\frac{1}{2}$ inch.

Locality.—Bracklesham Bay.

No. 74. *CYPRÆA BARTONENSIS*. *F. E. Edwards*. Tab. XVII, fig. 6*a*—*b*.

C. testá ovatá, ventricosá, subtilis depressiusculá, anticè attenuatá, lævi; spirá prominulá, vix obtectá, sulco obscuro circumdatá; aperturá lineari, angustissimá, anticè latiori, posticè elongatá, utraq̃ue extremitate sub-rostratá et emarginatá; labro extus marginato, anticè compresso, regulariter dentato; columellá subrectá, planulatá, anticè concavá, dentato-plicatá, dentibus posticis elongatis.

Shell ovate, ventricose, flattened beneath, attenuated in front, rather obtuse behind; spire somewhat elevated, scarcely concealed by the enamel, and encircled by an obscure sulcus formed by the suture: mouth nearly straight, very narrow, a little wider in front, produced behind, and presenting at each extremity a short canal, slightly notched; outer lip broad, thickened, so as to form a curved raised border along the outer

margin, flattened towards the base, and furnished with numerous regular teeth, of which the posterior ones are pliciform. The anterior canal is defined by an obscure, nearly vertical plait on the outer lip, and a curved elevated plait at the base of the columella; inner lip thickened, and spread out at the base, forming a prominent callus towards the front of the whorl, plicated along the whole length on the inner margin, and produced at the posterior extremity into a bluntly pointed projection which forms the left wall of the posterior canal. Columella nearly straight, flattened, and presenting towards the front end, a deep three-sided concavity connected with the body whorl by a short, wide depression; columellar teeth pliciform, the posterior ones longer and more oblique than the others.

This species, the prettiest of the English Eocene cowries, resembles *C. media*, (Desh.) more closely, perhaps, than any other of the fossil Cyprææ; but the elevated spire, the anterior callus, and the strongly marked posterior canal impart to it a distinct character.

Size.—Axis, rather more than 1 inch: diameter, 7-10ths of an inch nearly.

Locality.—Barton, where it is not very common.

No. 75. CYPRÆA TUBERCULOSA. *Duclos*. Var. COOMBII. *Sowerby*. Tab. XVI, fig. 2, Tab. XVII, fig. 5.

OVULA TUBERCULOSA, *Duclos*.

CYPRÆA DESHAYESII, *Gray*. (1832). (Add. to Mon. Cypr.) Zool. Journ., vol. iv, p. 83, No. 64*.

— — *G. Sow.* (1832). (Notes on Gray's Additions to Mon. Cypr.) Zool. Journ., vol. iv, p. 221.

OVULA TUBERCULOSA, *Desh.* (1824-37). Desc. des coq. foss., &c., vol. ii, p. 717, t. 96, fig. 16, t. 97, fig. 17.

— — *Desh.* (1844). 2d edit. Lam. Hist. nat., vol. x, p. 478, No. 3.

CYPRÆA COOMBII, *J. Sow.* (1850). Dixon's Geol. &c., Sussex, pp. 108 and 188, t. 8, fig. 6.

OVULA TUBERCULOSA, *D'Orb.* (1852). Podrome de Paléont., vol. ii, p. 314, No. 297.

C. testá magná, trigoná, ventricosá, lævi, dorso aliquando tuberculatá, subtus planulatá: aperturá elongatá, angustissimá, ferè edentulá, arcuatá, anticè latiori, utraq̃ue extremitate canaliculatá; canali posteriori ad spiram reflexo, canali anteriori recto: labro compresso posticè exserto, sub-auriculiformi, lateraliter expanso.

Shell large, trigonal, ventricose, smooth, sometimes presenting one or two tubercles on the back; base flattened, posterior end very broad, flattened, almost truncated: aperture elongated, curved, very narrow, rather wider in front, nearly if not altogether toothless, with a wide canal at each extremity; the anterior canal straight, the posterior one curved and bent upwards towards the spire; outer lip broad-edged, expanding at the posterior extremity into an ear-shaped projection.

The French specimens of the *Cypræa tuberculosa* are smaller and less triangular in form than our English shells; and the flattened posterior extremity is circumscribed by two lateral callosities which rise, one on each side, towards the back. This singular character, which forms a prominent feature in the specimen figured by M. Deshayes, and which I am assured by that gentleman is constant in the French shells, is wanting in the very few English specimens I have seen. Notwithstanding these differences, the English shells present such close affinities to the French specimens, that they must be regarded rather as a strongly marked local variety than as a distinct species. The dorsal tubercles, from which the specific name is taken, are stated by Mr. Sowerby not to be a constant character; they certainly appear to vary much in size and position, for in the figure and description given by M. Deshayes they are represented as of considerable size, and as ranged longitudinally about the middle of the shell; while in Duclos's original figure, they appear to be much smaller, and are placed transversely near the posterior extremity. The English specimen now figured, presents an even surface; but one, formerly in Mr. Bowerbank's museum, and which, unfortunately, has fallen to pieces, had a single large tubercle near the middle.

With regard to the genus to which this singular shell should be referred, a difference of opinion exists. The absence, or nearly obsolete condition, of the columellar teeth would seem to require that it should be placed, as in fact all the French authors have placed it, among the *Ovulæ*; but the pyriform shape, the aperture, and the general aspect of the shell belong rather to *Cypræa*. Dr. Gray has pointed out the analogy between it and the tuberculated variety of the recent *C. mus*, and asserting in fact, that M. Deshayes's specimen has a very few obscure teeth on the lips, he has stated that, in his opinion, the shell is evidently a cowry, an opinion from which Mr. George Sowerby has not dissented. On this authority, I have retained the shell in the present genus, of which, as Mr. James Sowerby has suggested, it may form with *C. mus*, a sub-genus.

Size.—Axis, 6 inches and 6-10ths; diameter, 5 inches.

Localities.—Bracklesham Bay, where it is rare. *French*: Rétheuil, Cuise-Lamotte, Pierrefonds, (Oise), (fide D'Orb).

Section—TRIVIA.

No. 76. *CYPRÆA PLATYSTOMA*. *F. E. Edwards*. Tab. XVII, fig. 7a—f.

C. testá parvá, ovato-oblongá, ventricosá, anticè attenuatá, transversim lineatá, apice elevato; lineis angulosis, numerosis, regularibus, sulco dorsali perspicuo, mediano, interruptis; spatiis inter lineas concavis; aperturá latá, posticè sub-productá, flexuosá, canaliculatá, anticè brevi latoque canali creanti, vix emarginatá; labro extús late marginato, in medio leviter arcuato.

Shell small, ovately oblong, ventricose, attenuated in front, almost pyriform; trans-

versely ridged; apex elevated; ridges slender, sharp-edged, numerous, (18 to 20), regular, interrupted by a dorsal sulcus; the spaces between the ridges regularly concave; aperture wide, with parallel margins, somewhat produced and curved behind, terminating in a short, wide canal, and slightly notched in front; the outer lip, towards the middle, is curved correspondingly with the shape of the body-whorl, and presents a wide but not much raised border along the outer edge. The dorsal sulcus, which is very distinct, becomes wider and deeper at each extremity. The transverse ridges are more numerous on the right lip than across the back, as several short ones rise out of the aperture, which scarcely extend beyond the outer margin. In the young shell, (fig. 7a—c), the right lip is obscurely dentated towards the front, but is otherwise smooth; it presents a raised border along the outer edge.

Size.—Axis rather more than 4-10ths of an inch; diameter, 3-10ths of an inch.

Localities.—Highcliff, and Alum Bay: (Strat. No 29, Prestwick).

No. 77. CYPRÆA WETHERELLII. *F. E. Edwards.* Tab. XVII, fig. 3a—d.

CYPRÆA PEDICULUS? *Webst.* (Observations on the strata over the Chalk, &c.,) Geol. Trans., 1st Ser., vol. ii, p. 204.

C. testá parvâ, sub-globosâ, transversim lineatâ; lineis tenuibus, numerosis; sulco dorsali vix conspicuo non interruptis; aperturâ sub-medianâ, leviter arcuatâ, posticè productâ, sub-canaliculatâ.

Shell small, nearly globose, slightly attenuated in front, transversely ridged; ridges thin, angular, not interrupted by the obscure dorsal sulcus, few in number as they emerge from the aperture, but becoming numerous by the bifurcation of some, and by the appearance of new ridges between others; aperture nearly central, narrow; slightly curved, produced behind, forming a short wide canal; outer lip ?

The specimen of this *Cypræa* from which the description and figure are taken is imperfect; the outer lip and the front of the columella are both broken, and the shelly matter on part of the back is decomposed, exposing a cast in the pyrites with which the interior of the shell is filled; but the posterior extremity of the outer lip and the triangular elevation which formed the left wall of the posterior canal remain. The continuation of the transverse ridges across the back of the shell, uninterrupted by the dorsal sulcus, is plainly shown.

This *Cypræa* is one of the many additions to our Eocene Fauna for which we are indebted to the indefatigable zeal of Mr. Wetherell, with whose name I designate the species. The specimen from which the figures are taken, was found in one of the cuttings made at Whetstone, on the formation of the Great Northern Railway. Another, and apparently a younger, specimen was also obtained by Mr. Wetherell from the railway cutting at Primrose hill.

Among the fossil Cyprææ found in the Paris basin, is one belonging to the present section, which Lamarck considered to be identical with the recent *Cyp. pediculus*, but which, M. Deshayes, in his 'Description des coquilles fossiles,' &c., has shown to be distinct, and has named *C. Lamarckii*. Mr. Webster (*loc. cit.*) has recorded a fossil cowry as occurring at Highgate, and at Stubbington, which he also refers to *C. pediculus*. I have not met with any Cypræa belonging to this section, either from Stubbington or Bracklesham Bay; but it is not improbable that the Highgate specimen mentioned by Mr. Webster belonged to the present species, which, however, is more globose than *C. Lamarckii*; with a wider aperture, and more numerous transverse lines.

Size.—Axis, rather more than 3-10ths of an inch; diameter, 3-10ths of an inch.

Localities.—Whetstone, near Barnet; Primrose-hill.

No. 78. CYPRÆA PRESTWICHII. *F. E. Edwards*. Tab. XVII, fig. 2a—c.

C. testâ parvâ, ovato-oblongâ, ventricosâ, anticè attenuatâ, canaliculatâ, vix emarginatâ, transversim lineatâ; lineis numerosis, tenuibus, irregularibus, sulco dorsali, sub-mediano, obscuro, interruptis; aperturâ angustâ, lineari; labro involuto.

Shell small, ovately oblong, ventricose, attenuated towards the anterior extremity, with a short canal, slightly notched in front, and covered with transverse ridges, interrupted on the back by an obscure, nearly medial sulcus; ridges slender, sharp-edged, numerous (18 to 20), irregular; aperture linear, narrow; outer lip incurved.

This Cypræa is not so pyriform as *C. platystoma*; the apex is not so elevated, the transverse ridges are less regular and not so numerous, particularly over the outer lip; and the aperture is linear without any posterior curve. The more globose form, the elongated aperture, and the posterior canal of *C. Wetherelli*, distinguish it from that species.

I am indebted for this cowry to Mr. Prestwich, to whom I have dedicated it.

Size.—Axis, rather more than $\frac{1}{4}$ of an inch; diameter, 2-10ths of an inch.

Locality.—Basingstoke.

Genus 21st. OVULA. *Bruguère*. 1792.

AMPHIPERAS, *Gronovius*, 1781.

LICIUM, *Humphrey*, 1797.

CYPHOMA, *Bolten*, 1798.

OVULA, *Lamarck*; *Cuvier*; *Ferrussac*; *Deshayes*; *G. B. Sowerby*; &c.

OVULUS, *Montf.*, 1810.

CALPURNUS, *Montf.*, 1810.

ULTIMUS, *Montf.*, 1810.

SCYMNIA, *Leach*, 1819.

SIMNIA, *Risso*, 1826.

CALPURNA, *Fleming*, 1828.

VOLVA, *Fleming*, 1828.

CYPRÆLLA, *Swainson*, 1840.

CARINEA, *Swainson*, 1840.

Sect. VOLVA, *Bolten*, 1798.

RADIUS, *Montf.*, 1810.

RADIUS, *Schum.*, 1817.

BIROSTRA, *Swainson*, 1840.

Gen. Char.—Shell ovate, gibbous, more or less attenuated or produced, and emarginate at each extremity; smooth, convolute upon a nearly horizontal plane; spire concealed: aperture longitudinal, elongated, narrow behind, more expanded in front; outer lip generally inflected, thickened, denticulated; inner lip smooth.

The *Ovulæ* present great similarities to the *Cyprææ*, both in the organization of the animal and the construction of the shell. The principal distinctions between the animals appear to be in the condition of the muzzle, and in the mantle, the surface of which, in the true *Ovulæ*, is always smooth. The shells are distinguished by the absence of teeth on the left margin of the aperture, and by the prolongation of the two extremities; but, like the *Cowries*, they are, when fully formed, smooth and polished, owing to the enamel-like coating secreted by the extended margins of the mantle.

The genus was first separated by *Gronovius*, under the name *Amphiperas*, and was afterwards defined by *Bruguère* under the present name, by which it has been generally received. Several dismemberments have been proposed by *Bolten*, *Fleming*, *Leach*, *Swainson*, and others, on conchological distinctions only. In one of these, the genus *Volva* proposed by *Bolten* for the well-known oriental shell, called the “weaver’s shuttle,” (*Ovula volva*), the animal, according to *Mr. Adams*,* presents certain peculiarities, consisting of a row of nipple-like tubercles along the edge of the mantle, and of a narrow foot folded longitudinally and adapted for crawling upon the round slender stems of the *Gorgoniæ* and other zoophytes on which the animal feeds, which modifications appear to confirm the separation; but the other proposed divisions are for the present received as sections only of the present genus until more accurate knowledge of the anatomy and habits of the animals is acquired.

The living *Ovulæ* are not very numerous, and are, for the most part, inhabitants of warm climates; they are found principally in the seas of China, Western America, and the West Indies; one species only is found on our own shores. The fossil *Ovulæ* are very few; seven species from the cretaceous formations, five of which were described as *Cyprææ*, are referred by *D’Orbigny* to this genus; two species, exclusive of *O. (Cypræa) tuberculosa*, before described, occur in the Eocene tertiaries of France, and three are found in the more recent formations.

* ‘Zoology of the Voyage of H. M. S. *Samarang*,’ p. 19.

No. 79. OVULA? ANTIQUA. *F. E. Edwards.* Tab. XVII, fig. 3a—b.

O. testá elongato-ovali, sub-ventricosá, posticè sub-acuminatá, lævi : aperturá angustá, posticè elongatá, in canali brevi, mediocriter lato, exeunti, anticè effusá.

Shell of a lengthened oval form, somewhat ventricose in the middle, slightly acuminate at the posterior extremity, smooth: aperture elongated, narrow behind; posterior canal short, moderately wide. The anterior extremity is broken; it appears to have been rather more obtuse than the posterior one. The last volution is smooth, but the surface of the preceding volution presents numerous transverse striæ, perspicuous towards the posterior extremity, and becoming obsolete as they approach the middle of the whorl; these striæ are very fine, so much so as to be barely perceptible by the naked eye.

The only specimen I have seen forms part of Mr. Wetherell's collection; it is too imperfect for a detailed description, or even for ascertaining satisfactorily the genus to which it belongs. It is apparently an immature shell just emerging from the first stage of growth before the outer lip has become thickened or involute, and when the absence of teeth on the columella is not conclusive of the genus. It may be the young shell of a *Cypræa*, resembling the *C. acuminata* of Melleville, and, therefore, I have referred it to the present genus with doubt, and have named it provisionally only.

Size.—Axis, $\frac{1}{2}$ an inch; diameter, 2-10ths of an inch.

Locality.—Primrose Hill.

Genus 22d. MARGINELLA.* *Lamarck.*

PORCELLANA, PERIBOLUS, *Adanson*, 1757.

DACTYLUS, *Humphrey*, 1797.

MARGINELLA, *Lamarck*, 1801.

MARGINELLUS, *Montfort*, 1810.

PERSICULA, *Schum.*, 1817.

VOLVARIA, (sp.,) *Lamarck*, 1822.

MARGINELLA, GLABELLA, } *Swainson*, 1840.

VOLUTELLA, GIBBERULA, }

PHENOSPIRA, CRYPTOSPIRA, *Hinds*, 1844.

Gen. Char.—Shell oval, oblong, smooth, enamelled; spire short, sometimes almost concealed: aperture elongate, narrow, truncate, sometimes broadly but not deeply notched in front; outer lip thickened externally, inner margin sometimes smooth, generally crenated; columella with distinct plaits, more or less numerous.

* Etym., Diminutive of *Margo*, a rim or margin.

This genus was first separated by Adanson, and afterwards by Humphrey, for shells previously referred either to *Voluta* or *Mitra*. Subsequently Lamarck defined it more exactly under the present name, by which it is now known. The animal resembles that of *Cypræa* in all essential particulars, and like it, is furnished with lobes to the mantle, which can be extended over the shell so as to cover the spire, which thus acquires an enamel-like covering resembling that of the Cowries. The condition of the spire, the number and the arrangement of the columellar plaits, and the simple or crenated state of the outer lip, have been used as characters for the separation of the *Marginellæ* into various genera; but these divisions do not appear to be warranted by generic distinctions in the animals and consequently, have not been generally adopted, but have been regarded as sections merely of the present genus. Mr. G. Sowerby (*Gen. Shells*), has suggested that the *Marginellæ* may be classed under two natural sections; the first comprising the species in which the spire is distinct, the columella furnished with four folds at the base, and the outer lip characterised by a thick fold-like border along the outer margin; the other consisting of the species in which the spire is short, almost concealed, the columellar plaits more numerous, the anterior plaits being the larger, and the outer lip but slightly thickened. The first section corresponds with *Glabella* (Swain.) and *Phænospira* (Hinds); the latter represents *Persicula* (Schum.), *Volutella*, *Gibberula*, *Marginella* (Swain.), and *Cryptospira* (Hinds).

The recent *Marginellæ* are numerous; they chiefly inhabit the tropical and sub-tropical seas, where they are found in shallow waters; they appear to abound on the coasts of Africa, and some few small species, belonging to the second section, are found in the Mediterranean. In the fossil state they first appear during the tertiary epoch. In the French eocene beds, eleven species occur, of which seven have been described by Lamarck and Deshayes; and of these, several are found in England, Germany, and Belgium. Six species from the corresponding formations in Alabama (U.S.), have also been described by Conrad and Lea: and in the more recent deposits in Europe and the United States, twenty additional species have been found.

Section A. Spire apparent.

No. 80. MARGINELLA EBURNEA. *Lamarck.* Tab. XVIII, figs. 1 *a—c*.

MARGINELLA EBURNEA, *Lamk.* 1803. Ann. du Mus., vol. ii, p. 61, No. 1; and vol. vi, t. 44, fig. 9.

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| — | — | <i>Roissy.</i> 1804. Buff. Moll., vol. vi, p. 9, No. 4. |
| — | — | <i>Lamk.</i> 1822. Hist. nat., vol. vii, p. 359, No. 15. |
| — | — | <i>Brogn.</i> 1823. Sur les ter. tert., du Vicent., p. 64, No. 1. |
| — | — | <i>Defr.</i> 1823. Dict. des sci. nat., vol. xxix, p. 145. |

MARGINELLA EBURNEA,	<i>Desh.</i>	1830. En. Méth. (Vers), vol. ii, p. 413, No. 13.
—	—	<i>Bronn.</i> 1831. Ital. Tertiärgeb., p. 18, No. 53.
—	—	<i>Desh.</i> 1824-37. Descr. des coq. foss., &c., vol. ii, p. 707, t. 95, figs. 14—16, and 20—22.
—	—	<i>J. Sow.</i> 1850. Dixon's Geol., &c., of Suss., p. 107.
—	—	? <i>Phil.</i> 1851. Palæontographica (Tert. Foss. Magd.), vol. i, p. 79, No. 174.
—	—	? <i>Beyrich.</i> 1853. Die Conchyl. des Norddeutschen tert., vol. i, p. 52, t. 2, figs. 9 a, b.
Nec. —	—	<i>Grat.</i> 1838. Cat. Zool., &c., de la Gironde, p. 50, No. 478.
nec. —	—	<i>Grat.</i> 1845. Conch. foss., &c., de l'Adour, t. 1, (Tarrière, &c.,) figs. 38—40.
nec. —	—	<i>Sismon.</i> 1847. Syn. meth., &c., Pedemont. Foss., p. 42, No. 46.

M. testá parvâ, orato-elongatâ: spirâ acuminatâ, ultimo anfractu breviori; anfractibus convexiusculis, ad suturam confluentibus; aperturâ angustâ; labro posticè sinuato, extus marginato, intus mutico; columellâ quadriplicatâ.

Shell small, elongated, with an elevated pointed spire, rather shorter than the aperture, and formed of five or six narrow, slightly convex whorls, somewhat depressed round the sutural margin, the sutures concealed by the enamel; body-whorl conoidal; aperture elongated, narrow, obscurely notched in front; lips nearly parallel; outer lip with a wide and moderately deep sinus at the suture, thickened and presenting a raised border along the outside margin, smooth within; columella nearly straight, and furnished with four narrow, almost equal folds, the front two of which are more oblique than the others.

M. Deshayes, when he separated *M. hordeola*, suggested at the same time that it might be only a variety of the present species; Dr. Beyrich in fact maintains the identity, and that the only distinction is the difference of size. I do not concur in this opinion. Both species belong to a group, in several of which the characters depend, to a great extent, on the condition of the aperture and the general form of the shell; characters in some instances difficult to define, but which strike the eye forcibly, and from their constancy acquire specific importance. The general form of the shell in *M. hordeola* is not so broad as that of *M. eburnea*, owing to the whorls being less convex; the spire is more obtuse, and comparatively shorter; and the aperture is longer and narrower, particularly at the posterior extremity, and it is more contracted at the middle in consequence of the greater involution of the outer lip. Other species occur in the *calcaire grossier*, belonging to this group, and hitherto undescribed, but which, as I learn from M. Deshayes, will be described in the forthcoming supplement to his 'Description des coquilles fossiles,' &c. One of these (*M. contabulata*), appears to be intermediate in size between *M. eburnea* and *M. hordeola*, and, in fact, to present a close general resemblance to the former. It is unnecessary to enter upon any examination

of the characters distinguishing this new species; but it is not improbable that Dr. Beyrich may have associated specimens of *M. contabulata* with the true *M. hordeola*.

It is always hazardous, without the assistance to be derived from actual specimens, to express an opinion on questions of identity; but the figure given by Dr. Beyrich does not convey to my mind an idea of *M. eburnea*; the spire seems to be shorter and thicker, the apex to be more obtuse; the aperture to be shorter, less wide in front, less narrow behind; the outer lip is represented without the posterior sinus, and the folds on the columella appear to be more oblique. The figure agrees much better with *M. contabulata*, to which species, if it had been published, the German shell would more probably have been referred.

The present species appears to be confined to the older tertiary formations; the shells from Dax, and the neighbourhood of Bourdeaux, referred to it by Grateloup, belong to a different species, which D'Orbigny has named *M. sub-eburnea*; as do those from Turin, described by Sismonda, and to which Michelotti has given the name, *M. Taurinensis*.

Size, of the specimen figured, which forms part of Mr. D'Urban's collection, is, axis, 3-10ths of an inch; diameter, half the length of the axis. The French specimens are frequently much larger.

Localities.—Bracklesham Bay, where it is very rare. *French*: Grignon, Parnes, Courtagnon, Ermenonville, Acy, le Tombray (fide D'Orb.). *Italian*: Ronca, Val Sangonini (fide Brogn.) *German*: Osterweddingen in Magdeburg? (fide Beyr.)

No. 81. *MARGINELLA BIFIDO-PLICATA*. Charlesworth. Tab. XVIII, figs. 2 a—g.

M. testá minimá, ovato-globosá, ad basin rix emarginatá; spirá conicá, breví, apice sub-obtusó; anfractibus convexis: aperturá angustá, longitudine spiram paulo superanti; labro crassissimo, compresso, extús marginato, intús acuto, posticè profundè emarginato; columellá quadriplicatá, plicis tribus posticis bifidis, pene transversis; plicá anteriori acutá, obliquá.

Shell very small, roundedly ovate, with a short, conical spire and a bluntish apex: aperture narrow, a little longer than the spire, with the margins nearly parallel: outer lip much thickened, presenting a prominent border along the outer margin, a sharp edge inwards, and a deep sinus near the suture; columella with four folds, of which the anterior one is sharp and very oblique, and the remaining three thick, bifid, and nearly transverse.

This marginella approaches very closely to a species from the Paris Basin, not yet described, but to which M. Deshayes has given the name *M. columbellina*, and a comparison with a longer series of that species than I possess, may eventually establish the identity. It appears, however, to be a broader and more ventricose shell, having a

shorter spire and a narrower aperture than *M. columbellina*, and the columellar plaits are more strongly bifid than in that species. The outer lip in the adult shell also is flattened in front, and its inner margin presents a sharp edge; whereas in the French species the outer lip is rounded and rather involute. I must state that in the young shell, the columellar plaits in *M. bifido-plicata* are thin and simple, and that the bifid character is assumed only at maturity.

The other species from the *calcaire grossier* (*M. contabulata*), to which I have before referred, appears to be a longer and narrower shell than the present one; the whorls are distinct, notwithstanding the enamel, and present an obscure channel running round the suture; the mouth is more effuse in front, the outer lip not so much thickened, the posterior sinus obscure, and the columellar plaits more oblique.

The present species is found in profusion in the Highcliff sands; and sparingly in the Barton Beds. Specimens are also found, rather plentifully, in the corresponding stratum (No. 29, of Mr. Prestwich), in Alum Bay, larger and more regular in form and with a somewhat longer spire than the type, but agreeing with it in all essential characters (figs. 2 *e—g*), and I consider the last, therefore, to be merely a local variety. It also occurs in the stratum No. 4, Prestwich, in Alum Bay, and at Bracklesham Bay. The specific name is taken from the bifid condition of the columellar plaits, a character found, however, in several other species belonging to this group, although not so strongly marked as in the present one; it was proposed by Mr. Charlesworth, in a lithographic print of the species forming part of a series of figures of shells from Highcliff and Barton, beautifully executed, under the direction of that gentleman, for distribution among the members of the "Natural History Society."

Size.—Type, Axis, somewhat less than 2-10ths of an inch; diameter, 1-10th of an inch.

No. 82. MARGINELLA GRACILIS. F. E. Edwards. Tab. XVIII, figs. 4 *a—c*.

M. testá minimá, tenui, subfusiformi, ad basin vix emarginatá; spirá elevatá, conicá, apice obtuso; anfractibus quinque, convexis: aperturá elongato-ovali, in longitudine spiram superanti, postice obscurè canaliculatá; labro incrassato, extus marginato; columellá quadriplicatá, plicis tribus posticis obliquis, bifidis.

Shell very small, slender, tapering nearly equally towards each extremity; spire elevated, conical, with an obtuse apex; whorls five, convex, the last whorl scarcely notched at the base: aperture of a lengthened oval shape, moderately wide, and rather longer than the spire; outer lip thickened within, and presenting a narrow, slightly raised border along the outer margin, and a small obscure channel at the suture; columella with four folds, of which the posterior three are bifid, and rather oblique.

This may be merely a variety or an immature state of *M. bifido-plicata*, and, as I have only two specimens before me, I have separated it with much hesitation. The

shell is, however, narrower and slenderer, somewhat resembling *M. hordeola* in shape, but more regularly fusiform. One of the specimens has the outer lip thickened and margined, and it appears therefore, to have attained maturity; but the posterior sinus characteristic of this group and which is so strongly marked in *M. bifido-plicata*, is wanting, and is represented by an obscure, scarcely perceptible channel at the suture. The lip itself is not involute as in *M. hordeola*, but is simply thickened, and the front is round, not flattened, as in *M. bifido-plicata*.

The specimen figured is from Mr. D'Urban's cabinet.

Size.—Axis, 2-10ths of an inch; diameter, rather less than 1-10th of an inch.

Locality.—Barton, where it is scarce.

Marginella dentifera. (Lamarck.) This species is recorded in the list of "The Fossils of Bracklesham and Selsey," published in Mr. Dixon's '*Geology, &c., of Sussex*,' p. 107, on the authority of a specimen which formed part of my collection, but which, unfortunately, has been broken: I am not aware that any other individual has been found. The species is very rare in France; and as Mr. Sowerby, by whom the list was prepared, did not himself see the specimen, the identification cannot be relied on; I have therefore not included *M. dentifera* among the English eocene Marginellæ.

Section B. Spire concealed or nearly so.

No. 83. MARGINELLA OVULATA. Lamarck. Tab. XVIII, figs. 5 a—c.

MARGINELLA OVULATA, *Lamk.* 1803. Ann. du Mus., vol. ii, p. 61; vol. vi, t. 44, fig. 10.

— — *Roissy.* 1804. Buff. Moll., vol. vi, p. 10, No. 6.

— — *Lamk.* 1822. Hist. nat., vol. vii, p. 359, No 17.

— — *Defr.* 1823. Dict. des sci. nat., vol. xxix, p. 145.

— — *Desh.* 1824-37. Desc. des coq. foss., &c., vol. ii, p. 707, t. 94 bis, figs. 27—29.

— — *Desh.* 1830. Enc. méth. (Vers), vol. ii, p. 416, No. 20.

— — *Bronn.* 1831. Ital. Tertiärgeb., p. 18, No. 52.

— — *Bronn.* 1838. Leth. geog., p. 1106, t. 42, fig. 44.

— — *J. Sow.* 1850. Dixon's Geol., &c., of Sussex, p. 107, t. 7, fig. 38.

— — ? *Beyrich.* 1853. Die Conchylien des Norddeutschen tert., vol. i, p. 49, t. 2, fig. 10a—b.

MILIACEA? *Philippi.* 1851. Palæontographica (Tert. foss. Magd.), vol. i, p. 79, No. 177.

Nec. — OVULATA, *Grat.* 1838. Cat. Zool., &c., de la Gironde, p. 50, No 481.

nec. — — *Grat.* 1845. Conchy. foss., &c., de l'Adour, t. 1, fig. 35.

nec. — — *Sism.* 1847. Syn. meth., &c., Pedemont. foss., p. 46.

M. testá ovato-oblongá, ad basin late emarginatá; spirá brevissimá: aperturá elongato-

angustá; labro sub-marginato, intús crenulato, posticè dilatato; columellá rectá, quinquies plicatá.

Shell oblong, ovate, with a very short obtuse spire, formed of but few whorls, the sutures of which are barely separated from each other; the body-whorl, which of itself forms almost the entire shell, is widely but not deeply notched in front. The mouth is long, narrow, and curved at the posterior extremity; the columella straight and, generally, furnished with five folds, occasionally with six or even more; the anterior folds are larger and more oblique than the others, which decrease in size as they ascend the columella. The outer lip is curved, expanding near the suture into a rounded wing-shaped projection; it is finely crenulated within, slightly thickened, and presents a narrow raised border running along the outer margin.

Some confusion appears to exist between the present species and a living species common in the Mediterranean (*M. miliacea*), placed by Lamarck in his genus *Volvaria*. This latter species is mentioned by Dujardin as occurring in the miocene formation in the neighbourhood of Tours; and Philippi and Sismonda have also recorded it as found in the upper miocene of Piedmont. Dujardin's shell, however, appears to be distinct, and the identification of the last is very questionable. The same species is also cited by Grateloup, although with a query, as identical with the present species, to which he has referred some shells from the miocene beds of Bourdeaux and Dax; but which, as well as certain shells from the synchronous beds of Turin, described by Michelotti as *M. ovulata*, belong to a different species to which D'Orbigny has given the name *M. sub-ovulata*. On the other hand, a *Marginella* from the miocene beds near Vienna, formerly considered to belong to the present species, has been regarded by Hörnes as identical with *M. miliacea*, and Philippi has also recorded a shell from Westeregeln, as belonging to the recent species. Dr. Beyrich, however, has pointed out with much precision, the specific differences between the *M. miliacea* and *M. ovulata*, and he seems to think that the shells mentioned by Hörnes and by Philippi, belong in fact, to the present species, which, apparently, is confined to the older tertiary formations; while, as yet, there is no ground for considering that *M. miliacea* occurs in any formation older than the upper miocene, if it occur even in that.

Whether or not the German shells are referable to the present species, is a doubtful question. The figure given by Dr. Beyrich does not agree with the French shells; the spire is more produced; the aperture, consequently, is proportionally shorter, and it is wider in front; the outer lip, apparently, is without the wing-shaped projection so characteristic of the true *M. ovulata*; and the folds on the columella are more distant and more oblique. Bronn's shell, so far as an opinion can be formed from the somewhat coarse and indistinct figure given by him, appears to agree much better.

The specimen figured is, I believe, unique, and although not in a very good state of preservation, is sufficiently so for determining the identity.

Size.—The French specimens of this species vary considerably in size, some ex-

ceeding half an inch in length; while others, in a state of maturity, barely attain half that size. The figured specimen is nearly 4-10ths of an inch long, by $\frac{1}{4}$ of an inch wide.

Localities.—Bracklesham, where it is very rare. *French*: Grignon, Parnes, Mouchy, Courtagnon, Creil, Vexin, Acy (fide D'Orb.). *Italian*: Castel-Gomberto, near Vicenza (fide Bronn), Magdeburgh (fide Phil.), Westeregeln? (fide Beyr.), Gainfahren? (fide Hörnes).

No. 84. *MARGINELLA PUSILLA*. *F. E. Edwards*. Tab. XVIII, figs. 6 *a—c*.

M. testá minimá, ovali; spirá exsertiusculá, apice obtuso: aperturá elongatá, mediocri, anticè profundè emarginatá; labro extús marginato, intús crenulato; columellá sub-rectá, quinquies vel sexies plicatá, plicis fere transversis, sub-æqualibus.

Shell minute, oval; spire slightly elevated, with an obtuse apex: aperture elongated, moderately wide and deeply notched in front; outer lip thickened along the outer margin, and finely crenulated within; columella nearly straight, with five or six folds, of which the anterior two are the longer and slightly oblique, and the others are almost transverse and nearly equal in size.

This pretty little *Marginella* appears to be perfectly distinct from all its congeners. It occurs rather plentifully in the Highcliff sands; but apparently disappears in the Barton sands and clay, as I have not met with any specimen from those deposits. It reappears in the fluvio-marine formation in Headon Hill, in which it is found sparingly.

Size.—Axis, not quite 2-10ths of an inch; diameter, 1-10th of an inch.

No. 85. *MARGINELLA SIMPLEX*. *F. E. Edwards*. Tab. XVIII, figs. 8 *a—c*.

M. testá ovato-oblongá; spirá brevissimá, pænè obtectá; aperturá elongatá, posticè angustá, anticè latiori, ad basin latè emarginatá; labro extús incrassato, intus mutico; columellá quinquies vel pluries plicatá.

Shell small, ovate-oblong; spire short, depressed, almost concealed; aperture elongated, narrow behind, effuse, and widely but not deeply notched in front; outer lip thickened along the margin, smooth, uncrenulated within; columella with two distant slightly oblique folds in front, and three or more obscure, nearly transverse, folds behind.

This species so closely resembles *M. ovulata* in its general aspect, that a hasty comparison would lead to the two being regarded as identical: there are, however, several differences which entitle the present shell to specific distinction. The spire is shorter and more depressed, and the anterior folds on the columella are more distant, and not so oblique; but that which particularly distinguishes *M. simplex* is the condition of the

outer lip, which is smooth within, nearly straight, and without the posterior dilatation which characterises *M. ovulata*.

Locality.—Estuary bed at Mead-end,"near Hordwell.

Size.—Axis, rather more than 3-10ths of an inch; diameter, 2-10ths of an inch.

No. 86. *MARGINELLA VITTATA*. *F. E. Edwards*. Tab. XVIII, figs. 7 *a—c*.

M. testá ovulatá; spirá brevissimá, depressá; aperturá elongatá, mediocri, antice effusá, profundè emarginatá; labro incrassato, intús obsoletè crenulato; columellá quadriplicatá, plicis anterioribus fere æqualibus.

Shell ovate-oblong, with a very short, depressed, almost hidden spire: aperture long, moderately wide, curved at the posterior extremity, effuse in front, and deeply notched at the base; outer lip thickened along the outer margin, feebly crenulated within; columella with three thickish, nearly equal folds in front, and an obscure one behind.

Although nearly resembling *M. ovularis* (Lamk.), this present species is easily distinguished from that by the general shape, which is shorter and broader, by the depressed spire, by the aperture, which is wider and without the contraction at the middle characteristic of the French species, and by the folds, which are not so numerous, and not quite so oblique. The narrower aperture, the smooth uncrenulate outer lip, the more numerous folds, and the greater size of *M. simplex*, separate that species from the present one.

One of the specimens exhibits faint traces of several transverse bands, from which circumstance the specific name is taken; these bands are of a dark brown colour.

Locality.—Headon Hill.

Size.—Axis, 3-10ths of an inch; diameter, rather more than half the length of the axis.

Family—VOLUTIDÆ.

Genus 23d. *VOLUTA*. *Linn.* 1767.

VOLUTA, *Scopoli*, 1777.

— *Bruguère*, 1792.

— *Lamarck*, 1801.

— *Montfort*, 1810.

MUSICA, *Humphreys*, 1797.

PLEJONA, *Bolten*, 1798.

FULGURARIA, *Schum.*, 1817.

SCAPHELLA—*HARPULA*—*VOLUTILITHES*, *Swainson*, 1840.

Gen. Char.—Shell sub-ovate or elongately fusiform, more or less ventricose; volu-

tions smooth, longitudinally ribbed, transversely sulcated or cancellated; spire short, apex pointed, or more or less mammellated; aperture longitudinal, large, notched at the base; outer lip thin and sharp-edged in the young state, sometimes thickened and plicated within at maturity; columellar plaits more or less numerous, oblique, the anterior plaits the largest.

The genus *Voluta*, as characterised by Linnæus, comprised the various shells in which the columellæ were plaited; and it represented, in fact, as a French author* has remarked, that group of genera which constituted Lamarck's family of *columellata*. After numerous dismemberments, the genus was defined first by Bruguière, and subsequently by Lamarck; but, even as thus restricted, a more extended knowledge of the animals has led to a still further curtailment of it by the withdrawal of the genera *Cymba* (Brod.) and *Melo* (Brod.)

The animal is of an oval form, with a large broad foot, extending beyond the shell on every side; the head is large, terminating in a short thick muzzle, and bearing short triangulated tentacles, at the outer bases of which the eyes are seated. The mantle, which is sometimes extended so as to cover the sides of the shell, is furnished with two lobes in front, between which it is produced into a short siphon, bent backwards towards the shell.

The recent *Volutes* are numerous, and many of them are of considerable size, and distinguished by the beauty of their colouring; they are, for the most part, inhabitants of equatorial seas, frequenting sandy bottoms. In the fossil state they are equally numerous; they first appear in the earlier cretaceous deposits, and nearly twenty species from the several formations of that epoch at Pondicherry, and in different parts of Europe, have been described by Professor E. Forbes and by Dr. Mantell, Matheron, D'Orbigny, and others. More than twice that number have been described by MM. Lamarck, Deshayes, J. Sewerby, Nyst, Philippi, and other authors, from the Eocene formations in Europe, and by Conrad and Lea from those of Maryland and Alabama, in the United States; while upwards of twenty species have also been described from the more recent formations.

On a comparison between the recent *Volutes* and their Eocene congeners, the prevailing characters of the two groups may be stated, in general terms, to be that, in the recent shells, the apex of the spire is broadly mammellated, the volutions are smooth or longitudinally costated, and the columellar folds thick and prominent; while, in the fossil shells, the apex is generally pointed, the volutions for the most part are transversely striated, sometimes cancellated, and the columellar folds are indistinct or comparatively feeble. These distinctions induced Mr. Swainson to separate the fossil species under the generic name *Volutilithes*, taking *Vol. spinosa* (Lam.) as the type. A cursory examination of the two groups, however, will suggest, I think, that a generic

* C. d'Orbigny's 'Dictionnaire Universel d'Histoire Naturelle.' Art., *Volute*.

separation is unnecessary. The mammellated apex, which is formed by the large development of the shell in embryo, cannot be regarded as a character of generic value; in fact, we find, among the recent Volutes, on the one hand, every degree of development between the broadly mammellated apex of *Vol. imperialis* and the pointed, almost mucronate, spire of *Vol. Harpa*; and among the fossil Volutes, on the other hand, we may trace the apex gradually enlarging from the small conical pullus of *V. luctatrix* and *V. spinosa* through *V. cithara*, *V. muricina*, &c., into the papillary pullus of *V. Wetherelli*, and thence into the mammellated apex of the Crag species, *V. Lamberti*. Similar variations may be observed in the condition of the columellar plaits. The characters in question, therefore, cannot, I think, be regarded as of generic value, however useful they may be for the division of the genus into groups.

Since the genus *Volutilithes* was proposed, the recent species *V. abyssicola* has been discovered. This Volute, which was dredged off the Cape of Good Hope at the great depth of 132 fathoms, presents a very close resemblance to some of the Eocene species, and appears to be the sole living representative of the group.

By far the greater part of the numerous eocene species which belong to this genus, are ribbed, or crowned with spines, and transversely furrowed; and the specific characters are taken chiefly from the varied conditions or the absence of these ornaments, and also from the condition of the outer lip, and the columellar folds. With regard to the specific distinctions which depend on the condition of the ribs and spines, or on the transverse sulcation, it must be borne in mind that these characters are subject to considerable modification by age; and that in almost all the species, the shells, even those which are simple and smooth at maturity, are, in their very early state, ribbed and coronated, as well as transversely sulcated. In some species, these ornaments disappear after the first three or four whorls; in others they become gradually more or less obliterated as the shells are enlarged; and the ribs in the young shells are, almost invariably, more numerous, and extend further over the whorl than in mature specimens. The character of the spines is subject to considerable modification, and the number of the columellar folds is also liable to slight variation in the same species. These characters, therefore, must be used with caution, and with a due regard to the apparent age of the specimens. The characters which appear to be the most certain are those which depend on the condition of the pullus or embryonic shell, on that of the notch at the base of the shell, and on the more or less effuse state of the inner lip. The condition of the notch, in case the notch itself is not preserved, will be found represented by the ridge at the base of the columella, called the "comb" or "crest," which is due to the reflexion of the base of the shell caused by the notch, and will be more or less prominent, according to the greater or less depth of the notch.

The following distribution of the English species into groups is made solely with a view to assist the student in the frequently perplexing task of arrangement; and it is

not proposed as possessing any value, except in so far as it may contribute towards the attainment of that end.

†

Section A. Pullus small, conical.

a. Shell turbate or pyriform; costated or coronated; inner lip effuse; columellar plaits few.

a. Transversely furrowed.

No. 87. VOLUTA LUCTATRIX. *Solander*. Tab. XVIII, fig. 3. Tab. XIX, fig. 3 *a—e*.

LIMINGTON THORNEY-RIBS, *Petiver*, 1764. *Gazophylacium*, t. 78, fig. 11.

STROMBUS LUCTATOR, *Solander*, 1766. *Brand. Foss. Hant.*, p. 30, figs. 64 and 67.

— DUBIUS — — — — — fig. 68.

VOLUTA MUSICALIS, *Webster*, 1814. *Geol. Trans.*, 1st ser., vol. ii, p. 204.

— LUCTATOR *Sowerby*, 1816. *Min. Con.*, vol. ii, p. 29, t. 115, fig. 1.

— — — — — 1823. — — — — — vol. iv, p. 134, t. 397.

V. testá elongato-turbinatá, costatá, transversim sulcatá, antice late emarginatá; apice acuto: anfractibus superne concavis, angulatis, und serie spinarum, costas coronantium, donatis; spinis brevibus, cuspidatis: aperturá in medio effusá, antice angustatá; columellá duas plicas obliquas prominentes gerenti; labro ad marginem crenulato, intus levi, in juventú sæpe plicifero, incrassato.

Shell elongately top-shaped, contracted in front, longitudinally ribbed, transversely furrowed; whorls angular at the shoulder, concave between the angle and the suture, and widely, but not deeply, notched in front; ribs sharp, curved, extending over nearly two thirds of the whorls, and crowned by a single row of erect, laterally compressed spines. In young shells the ribs are numerous, and a second row of small, irregular spines runs round the sutural margin; but the ribs become more distant, and the second row of spines disappears as the shell approaches maturity. The furrows are numerous, regular, rather broad and flat, and roughened by the prominent lines of growth. Spire elevated and pointed, the embryonic shell consisting of two or three very small, roundish, whorls; aperture angular behind, effuse at the middle; columella round, nearly straight, furnished with two unequal, oblique, prominent folds towards the front, the anterior one of which is the larger, and generally with two or three smaller ones behind. The outer lip in the young shell thickened and frequently plicated within; the plaits, however, when they do occur, disappear as the shell is enlarged, and in adult specimens the inner surface of the lip is smooth; in all stages of growth the outer lip is crenulated on the margin. Not infrequently, specimens occur in which the pearly matter, deposited by the margin of the mantle, remains; it is spread over the front of the body whorl, extending backwards almost to the suture.

Lamarck has cited *Strombus luctator* (Brand., fig. 64) as identical with his *V. musicalis*;

the latter, however, is a shorter, thicker, and coarser shell, with a proportionally longer spire; the columellar folds are four, more transverse, and nearly equally prominent; the outer lip, in all stages of growth, is without plaits, and the inner lip, which is but little spread out, does not extend backwards beyond the suture. Brander's shell (fig. 65) does not belong to this species; and Lamarck, in fact, referred it to his *V. spinosa*, which is, however, a much less ventricose shell. It belongs to Mr. Sowerby's *V. spinosa*, var. β .; the latter is, as that gentleman suggested, a distinct species, and I have separated it under the name *V. Solandri*. Brander's *Strom. dubius* (fig. 68) is without doubt a young individual of the present species.

Size.—Axis, 5 inches nearly; diameter $2\frac{1}{2}$ inches nearly.

Localities.—Barton Cliff and the corresponding formation in Alum Bay (Stratum No. 29, Prestwich.) Bracklesham Bay?

No. 88. *VOLUTA NODOSA*. Sowerby. Tab. XIX, figs. 1 *a—h*.

VOLUTA NODOSA, Sow. 1818. Min. Con., vol. iv, p. 135; t. 399, fig. 2; vol. 7, p. 6; t. 613, fig. 1.

— — *Defr.* 1829. Dict. des Sci. nat., vol. lviii, p. 481.

— — *Sow.* 1850. Dixon's Geol. &c., of Suss., p. 103; t. 5, fig. 23.

— *DEVEXA?* *Beyr.* 1853. Die Conchyl. des Norddeut. tertiär., vol. 1, p. 61; t. 3, figs. 6 *a, b*, 7 *a, b*.

V. testá ovato-acutá, obscure costatá, transversim sulcatá; spirá elevatá, sub-conicá, apice acuto: anfractibus obtuse angulatis, biná serie spinarum nodiformium coronatis; aperturá angustá, in medio latiori; labro ad marginem crenulato, intus plicato; labio late expanso; columellá triplicatá.

Shell ovate, pointed, obscurely ribbed, transversely furrowed; spire elevated, almost conical, with a small pointed apex; whorls, five or six, slightly convex, obtusely angulated at the shoulders; the ribs, which in the fully-grown shell are obscure and scarcely extend to the middle of the whorl, terminate at the shoulder in a row of blunt, nodiform spines; a second row of blunt spines, corresponding with the first, runs round the sutural margin, but becomes almost obsolete on the last whorl. The space between the suture and the shoulder is moderately wide, slightly concave, obscurely sulcated; the furrows on the whorls are narrow, concave, and separated by wide flat spaces, roughened by sharp conspicuous lines of growth. The aperture is rather narrow at each extremity, wider in the middle; the outer lip bluntly angulated towards the posterior extremity, crenulated on the margin, and plicated within; the inner lip is spread over the front of the body-whorl, extending backwards to the spines on the preceding whorl, and much thickened; the columella is a little flattened, and furnished with three folds, the anterior one of which is distant from the others, and large and prominent.

The present species, founded on a specimen from Barton Cliff, is widely spread, and ranges downwards to our older Eocene formations; since the Volutes which

occur so abundantly in the neighbourhood of London, as well as some from Bracklesham Bay, although they present points of difference, yet, on the whole, agree so closely with the type that they cannot be regarded otherwise than as local varieties. In the Highgate shells (figs. 1 *c*, *d*), the second row of spines disappears more early than in the Hampshire specimens, and the sutura margin is much thickened; the columella and the folds upon it, in the younger specimens, resemble those of the type, but, in the mature shell, the columella is more flattened, and additional folds arise among the normal ones, which latter become thicker and more prominent, the whole assuming a callus-like appearance; the outer lip also is thickened, and the principal spines are not so nodiform. The identity of the Bracklesham Bay shells (figs. 1 *c*, *h*), with the present species is not so obvious; in them the whorls are wider and more sharply angulated on the shoulder, the ribs are generally more distant, and the spines acute and larger; but among the Highgate shells individuals occur in which the whorls are more sharply angulated, and the spines sharp and projecting. In the thickened sutural margin, the thick, plicated outer lip, the condition of the columella, and the character of the columellar folds, the Bracklesham Bay shells agree with those from Highgate, and I am unwilling, therefore, to consider them to be distinct from the present species.

Dr. Beyrich (*loc. cit.*) has described a Volute from Westeregeln, in Magdeburg, which he has named *V. deveva*, and which he considers to be identical "with a species from Barton not described by Mr. Sowerby;" and, he adds, that "most certainly" his species cannot be the young condition of "*V. nodosa*, for which the species in question from Barton seems to have been considered." Dr. Beyrich refers to the Highgate Volute, figured in vol. 7, Min. Con. (t. 613, fig. 1), which, he says, "in fact resembles the *V. deveva* of Barton;" and also to the Bracklesham Bay Volute figured in Mr. Dixon's work; and this last, he adds, "judging from the figure, is scarcely distinguishable from the Barton species." One of the prominent characters of the Hampshire shells is the very obtuse angle at which the whorl is bent at the shoulder, giving a sub-conical form to the spire. This character distinguishes the Highgate shells, although, as I have stated, it is less strongly marked in those from Bracklesham Bay; it is also found in the Westeregeln shells, and is particularly noticed by Dr. Beyrich; but I know of only one other Volute from the Hampshire beds which possesses it (*V. ambigua*, Sol.), and this species, even in the costated variety, is perfectly distinct. I am at a loss, therefore, to conceive what the Barton shell is to which Dr. Beyrich refers. His *V. deveva* agrees so closely with the Highgate form, both in description and figure, that considering, as I do, the Highgate shell to be merely a local variety of the Hampshire *V. nodosa*, I should have cited *V. deveva* as identical without hesitation, had not that gentleman expressly stated that it could not be referred to the present species.

Size.—Axis, 2 inches; diameter, 1 inch.

Localities.—Barton, Bracklesham Bay, Highgate, Sheppey. *German*, Westeregeln in Magdeburg? (fide Beyr.)

No. 89. VOLUTA AMBIGUA. *Solander*. Tab. XIX, figs. 4, *a*—*c*.STROMBUS AMBIGUUS, *Soland.* 1766. Brand. Foss. Hant., p. 32; t. 5, fig. 69.VOLUTA BICORONA, *Webster*. 1814. Geol. Tran., 1st Ser., vol. ii, p. 204.— AMBIGUA, *Sowerby*. 1823. Min. Con., vol. iv, p. 135; t. 399, fig. 1.Nec — — *Lamk.* 1811. Ann. du Mus., vol. xvii, p. 78, No. 12.nec — — *Ib.* 1822. Hist. natur., &c., vol. x, p. 352, No. 12.nec — — *Desh.* 1824-37. Desc. des coq. foss., vol. ii, p. 691; t. 93, figs. 10, 11.nec — — (Var. *Monstrosa*) *Sow.* 1816. Min. Con., vol. ii, p. 31; t. 115, fig. 5.nec — — *Mant.* 1822. Foss. of the S. Downs, p. 108; t. 18, fig. 8.nec — — *Grat.* 1845. Conchyl. foss., &c., de l'Adour, t. 1, figs. 14, 15.nec — — *Rouault.* 1850. Desc. des foss., &c., de Pau. (Mém. de la Soc. Géol. de France, 2d ser., vol. iii, p. 457; t. 18, figs. 15, 16.)nec — — *D'Arch.* 1850. Desc. des foss. du groupe Nummul. (Mém. de la Soc. Géol. de France, 2d ser., vol. iii, p. 447.)

V. testá orato-oblongá, costellatá, transversim sulcatá, ad basin emarginatá; spirá conicá, elevatá, apice acuto: anfractibus convexis, per-obtuse angulatis; costellis numerosis, irregularibus, tuberculis per-minutis, acutis, terminantibus: aperturá postice sub-canaliculatá, angustatá, in medio effusá; labro intus incrassato, plicato, ad marginem crenulato; columellá sub-rectá, rotundatá, bis vel ter plicatá.

Var. COMPRESSA testá costatá; anfractibus angulatis; costis pro-eminentibus, sub-distantibus, compressis, tuberculis nodiformibus coronatis.

Shell ovately oblong, longitudinally ribbed, transversely furrowed, widely, not deeply notched in front; spire conical, elevated, pointed; whorls convex, scarcely angulated at the shoulder; ribs numerous, irregular, slender, extending nearly to the base of the shell, and terminating above in a single row of very small spines or pointed tubercles; in the young state a second row of imperfect spines runs round the whorl near the suture, but disappears as the shell is matured. The space between the suture and the row of tubercles is nearly flat, and presents a slender, but prominent, raised line running along the middle, and sometimes an additional faint one on each side of the centre line. The furrows are rather numerous, irregular, and traversed by very fine, but conspicuous, lines of growth. The aperture is contracted at the posterior extremity, effuse at the middle; the outer lip much thickened, plicated within, and crenulated on the edge; the columella round, straight, and furnished with two nearly equal prominent oblique folds in front, and sometimes one or two obscure ones behind.

The rounded shoulders, convex whorls, and conical spire, impart to this Volute a regularity of form which distinguishes it from all its congeners. The margins of the mantle of the animal appear to have been capable of considerable extension, for the porcellanous matter deposited is occasionally found widely spread, covering the whole

of the under surface of the body-whorl, and reaching almost to the very apex of the spire.

A Volute from the lower *calcaire grossier* has been referred by Lamarck, and subsequently by Deshayes, to Brander's *Strom. ambiguus*; the French shell, however, is quite distinct, not only as to the spire, which, owing to the flattened sutural margin of the whorls, has a turreted aspect, but also as to the condition of the spines, the columella, and the columellar folds. Lamarck's shell is, in fact, the *V. elevata* of Sowerby. Deshayes has also cited Brander's fig. 70 for his *V. ambigua*; that shell is, however, equally distinct; it is the *V. suspensa* of Sowerby. Lamarck's *V. bicorona*, for which that author, as well as Deshayes, has cited Brander's fig. 69, is distinguished from this species by the double row of tooth-like spines which crowns the whorls, by the shorter and less conical spire, and by the smooth outer lip.

Specimens frequently occur in the sands of Barton, in which the ribs are less numerous, more prominent, and laterally compressed; the tubercles assume the form of erect, blunt spines: the outer lip is thin and crenulated, and, in many instances, smooth within, although in others a comparatively feeble internal plication is found. These specimens present a close resemblance to immature shells of *V. luctatrix*, and, on a cursory examination, might be referred to that species. The largest of the many I have seen, barely exceeds in size the individual figured (fig. 4, *c*), and, in all instances, the conical form of the spire and the obtusely angulated condition of the whorls which characterise the present species are found. I am induced, therefore, to regard these shells as forming a variety of *V. ambigua* rather than of *V. luctatrix*.

The Volute from the chalk formations of Sussex, described by Dr. Mantell, does not belong to the present species to which that author referred it, and D'Orbigny ('Prod. de Pal.,' vol. ii, p. 154, No. 171) has named it *Pseudo-ambigua*. Grateloup's shells, from Dax, Gaas, and Lesbarritz, belong to Lamarck's *V. ambigua*, to which species they are referred.

Size.—Axis, rather more than 2 inches; diameter, 9-10ths of an inch.

Localities.—Barton; Alum Bay (Stratum No. 29, Prestwich).

No. 90. VOLUTA DIGITALINA. Lamarck. Var. LIMA. Sowerby. Tab. XIX, figs. 2 *a—c*.

BUCCINUM SCABRICULUM, Sol. 1766. Brand. Foss. Hant., p. 33; t. 5, fig. 71.

VOLUTA DIGITALINA, Lamk. 1811. Ann. du Mus., vol. 17, p. 77, No. 10.

— — — *Ib.* 1822. Hist. Nat., vol. vii, p. 351, No. 10.

— LIMA, J. Sow. 1823. Min. Con., vol. iv, p. 136; t. 398, fig. 2.

— DIGITALINA, DeFr. 1829. Dict. des Sci. nat., vol. lviii, p. 477.

— — — *Desh.* 1824-37. Desc. des coq. foss., vol. ii, p. 693; t. 93, figs. 1, 2.

— LIMA, Morris. 1843. Cat. Brit. Foss., p. 168.

— SCABRICULA, D'Orb. 1850. Prod. de Pal., vol. ii, p. 415, No. 1468.

— CRENULATA. Sow. 1850. Dixon's Geol., &c., of Sussex, t. 5, fig. 22.

V. testá ovato-oblongá, costatá, transversim sulcatá, antice sub-profunde emarginatá; spirá brevi, acuminatá: anfractibus convexiusculis, uná serie spinarum dentiformium coronatis, ad margines suturales planatis; costis numerosis, angustis, acuti-nodosis, ad basin tendentibus: aperturá elongato-angustá; labro intus incrassato, plicato, ad marginem crenulato; columellá triplicatá.

Shell oblong-oval, ribbed, transversely sulcated, rather deeply notched at the base; spire short, pointed; the ribs narrow, rather numerous, extending to the very base of the whorl: whorls rather convex, crowned by a single row of short, erect, sharp tooth-like spines, between which and the suture the margin is flattened, forming a narrow channel or ledge, which runs round the spire and gives a turreted aspect to the shell. The furrows are separated by a narrow line, which rises into small pointed knobs, where it crosses the ribs, and are roughened by numerous sharp, perspicuous lines of growth; the last furrow, immediately in front of the spines, is wider than the rest. The aperture is long and narrow; the outer lip thickened, plicated within, and crenulated on the margin; the inner lip is not much spread over the body whorl, and does not extend backwards beyond the suture.

In the French shells the ribs are close and broader; the elevated parts, where they are crossed by the furrows, are consequently blunter and more nodiform than in the English shells; the ribs also, instead of being crowned with erect pointed spines, terminate in thick round knobs, which extend partly over the margin towards the suture, and the outer lip, although thickened, appears to be not plicated within. Dr. Beyrich considers *V. lima* to be a different species to *V. digitalina*; but in all respects, except those pointed out, the two agree so well that, notwithstanding this high authority to the contrary, I regard the French shell as a local variety only of Brander's *Bucc. scabriculum*.

The shell from Bracklesham Bay, figured in Mr. Dixon's work (t. 5, fig. 22) as *V. crenulata*, belongs in fact to this species. Defrance, indeed, suggests that *V. scabriculum* may probably be only a variety of *V. crenulata*, modified by local conditions. It is difficult to ascertain to what extent specific characters may be modified by external conditions; but the different sculpture, the narrower aperture, the deeper notch, the less effuse inner lip, and the thickened plicated outer lip of the shells under description, appear to me to justify their being retained as a distinct species.

Size.—Axis, 1 inch and 4-10ths nearly; diameter, 6-10ths of an inch nearly.

Localities.—Barton, Alum Bay (Stratum No. 29, Prestwich), Highcliff, Bracklesham Bay. *French*: Valmondois, Betz, Monneville, Tancrou (fide Desh.).

No. 91. VOLUTA ELEVATA. Sowerby. Tab. XX., figs. 2. *a—d*.

- VOLUTA AMBIGUA, *Lamk.* 1811. Ann. du Mus., vol. xvii, p. 77, No. 12.
 — — *Ib.* 1822. Hist. nat. &c., vol. vii, p. 352, No. 12.
 — — *Desh.* 1824-37. Descr. des coq. foss., vol. ii, p. 691; t. 93, figs. 10, 11.
 — ELEVATA, *Sow.* 1840. Min. Conch., vol. vii, p. 7; t. 613, fig. 4.
 — AMBIGUA, *Gratel.* 1845. Conch. foss. &c., du bassin de l'Adour, Supp. Volutes, t. i, figs. 14, 15.
 — — *D'Arch.* 1850. Desc. des foss. du groupe Numm. (Mem. de la Soc. Géol. de France, 2d ser., vol. iii, p. 447).
 — — ? *Rouault.* 1850. Desc. des foss. &c. des environs de Pau (Idem, 2d ser., vol. iii, p. 457).
 — SUB-AMBIGUA, *D'Orb.* 1850. Prod. de Paléont., vol. iii, p. 10, No. 150.

V. testá oblongo-oratá, sub-turritá, transversim sulcatá, longitudinaliter costatá; spirá elevatá, acutá: anfractibus convexiusculis, ad margines suturales planatis; sulcis posticis latioribus; costis fere ad basin tendentibus, duas vel tres series spinarum dentiformium inter sulcos posticos gerentibus: labro ad marginem crenulato; labio parum expanso; columellá tri-plicatá.

Shell of a lengthened oval form, longitudinally ribbed, transversely furrowed, deeply notched at the base; spire elevated with a small pointed apex: whorls slightly convex, with the sutural margins depressed so as to form a narrow flat space, which runs round the spire; furrows numerous and regular until they approach the shoulder of the whorl, where the last three or four become gradually wider; the longitudinal ribs, which are more or less numerous in different individuals, extend almost to the very base of the whorl, and are surmounted by several rows of short tooth-like spines rising out of the spaces which separate the posterior furrows. The outer lip is smooth within, and crenulated on the margin by the transverse sulci; the inner lip is but slightly spread out, and does not extend backwards beyond the suture; the columella bears three very oblique folds, of which the anterior one is the largest.

This species was founded on a shell from the neighbourhood of London; it occurs also at Bracklesham Bay, but in the specimens from that locality the spire is not so elevated, and the shell is altogether shorter and broader.

The French shells referred by Lamarck to Brander's *Strombus ambiguus*, belong to the present species; but in them, as in the Bracklesham Bay shells, the spire is less elevated, and the shell is broader. In other respects they agree with the type.

A beautiful series of this Volute was obtained from the Artesian well at Southampton by Mr. Keele, for the use of which I am indebted to the kindness of that gentleman. One of this series is represented by figs. 2 *c, d*; figure 2 *b* is taken from a specimen from Highgate.

M. Rouault has described some shells from Bos d'Arros, in the neighbourhood of Pau, which he considers to be varieties of Lamarck's *V. ambigua*; but, judging from the figures given, they appear to be equally distinct from that species, and from Solander's *Stromb. ambiguus*. M. D'Archiac merely records the species without figure or description; but one of the localities given by him is Bos d'Arros, and the shells to which he refers may, therefore, belong to the same species as those described by M. Rouault. I have on this account cited his work, as well as that of M. Rouault, with a query. The shells from Dax and its neighbourhood, figured by Grateloup, D'Orbigny considers to belong to a distinct species, which he has named *V. sub-ambigua*; but, judging from the figures and from the only specimens I have seen from that locality, they appear to belong to Lamarck's *V. ambigua*, and I retain them as identical with the present species, although presenting some trifling differences.

Size.—Axis, 1 inch and 9-10ths; diameter not quite 9-10ths of an inch.

Localities.—Highgate, Camden Town, Hornsey, Nuneham, Southampton, and Bracklesham Bay. *French*: Rétheuil, Cuise-Lamotte, Dax, Gaas, Lesbarritz, (fide Grat.), Biarritz, Bos d'Arros, Les Corbières (fide D'Arch.), Valognes? (fide Rouault)?

No. 92. *VOLUTA CRENULATA*. *Lamarck*. Tab. XX, figs. 1. *a—b*.

VOLUTA CRENULATA. *Lamk.* 1802. Ann. du Mus., vol. i, p. 478, No. 8. vol. xvii, p. 77, No. 9.

—	—	<i>Ib.</i>	1816. Tableau Encyc. et Méth., t. 384, fig. 5.
—	—	<i>Ib.</i>	1822. Hist. natur., &c., vol. vii, p. 351, No. 9.
—	—	<i>Defr.</i>	1829. Dict. des Sci. nat., vol. lviii, p. 476.
—	—	<i>Desh.</i>	1833. Encycl. méthod. (Vers,) vol. iii, p. 1145, No. 28.
—	—	<i>Ib.</i>	1824-37. Descr. des coq. foss., &c., vol. ii, p. 693; t. 93, fig. 5—9.
—	—	<i>Bronn.</i>	1838. Lethæa geognost., p. 1106; t. 42, fig. 4.
—	—	? <i>Brogn.</i>	1823. Sur les terr. &c. du Vicent., p. 63.
—	—	? <i>Bronn.</i>	1831. Ital. Tertiärgeb., &c., p. 18, No. 55.
Non. —	—	<i>Sow.</i>	1850. Dixon's Geol., &c., of Sussex, t. 5, fig. 22.

V. testá oblongo-ovatá, costas longitudinales creberrimas, acutas, dentato-crenatas, ad basin tendentes et sulcis transversis numerosis decussatas, gerenti, anticè parum emarginatá; spirá brevi, sub-turritá, apice acuto: anfractibus ventricosis, superne bi-canaliculatis, duplici serie spinarum dentiformium coronatis; columellá quadruplicatá.

Shell ovate-oblong, rather ventricose, transversely furrowed, longitudinally ribbed, and but slightly notched in front; spire short, with a small pointed apex: whorls convex, depressed at the sutural margin, presenting a narrow channel round the spire, crowned by a double row of short, erect, pointed spines, which correspond with the posterior extremities of the ribs; the ribs, which are crowded, narrow, and extend to the very base, are cancellated by deep, transverse furrows, and at the points of section rise into tubercles, which, near the base of the whorl, are short and nodiform, but which, as they approach

the posterior margin, become gradually elevated and sharp, until at length the tubercles between the last three or four furrows assume almost the character of the spines which crown the whorls. The transverse furrows are numerous, and the last, which separates the two rows of spines, is much wider than the others. The aperture is moderately wide; the outer lip thin and crenulated on the margin by the furrows, but smooth within; the inner lip spread widely over the body whorl, extending backwards a little beyond the aperture; the columella presents four not very oblique folds, of which the anterior one is the largest and most prominent, and the posterior two are feeble.

In the French specimens of this beautiful Volute the ribs are more numerous and stronger, and the tubercles at the points of decussation are consequently more nodiform, and are less elevated than in the English shells. A similar variance characterises the French *V. digitalina*, as I have before observed, and as our specimens of the present species agree very well in other respects with the French shells, I can only regard them as a local variety.

It is this species which the recent *V. abyssicola* most nearly resembles; but although that interesting shell presents a striking analogy with it, the much closer, more sharply defined, and more delicate character of the cancellation which ornaments the surface, the shorter spire, the more oblique and more slender columellar folds, and the less expanded inner lip sufficiently distinguish it.

Brogniart, in his list of fossil shells from the tertiary formations of the Vicentin, mentions the present species, but remarks that it approaches more nearly to the Barton form than to that from the Paris Basin; an observation which is repeated by DeFrance. As *V. digitalina* is the Barton Volute which presents the nearest affinity to *V. crenulata*, it is to that species I presume that these authors refer; it is doubtful, therefore, whether the Vicentin shells ought not to be referred to *V. digitalina* rather than to the present species, and as I have not had an opportunity of examining any specimens, I have cited the Italian Volutes, but with doubt. The shell represented by fig. 22 (t. 25) in Mr. Dixon's work, and referred by Mr. Sowerby to this species, appears to me, as I have already observed, to belong to *V. digitalina*.

Size.—

Localities.—Bracklesham Bay. *French*: Parnes. Grignon, (fide Desh.). *Italian*: Ronca, Val Salgonini, (fide Bronn et Brogn.)?

No. 93. VOLUTA SOLANDRI. *F. E. Edwards*. Tab. XX, figs. 6. *a—d*.

STROMBUS LUCTATOR, *Soland*. 1766. Brand. Foss. Hant., p. 30; t. 5, fig. 65.

VOLUTA SPINOSA, *Webster*. 1814. Geol. Trans., 1st ser., vol. ii, p. 204.

— — *Sow*. 1816. Min. Con., vol. ii, p. 30, t. 115, fig. 2—4.

— — *Morris*. 1843. Cat. Brit. Foss., p. 168.

V. testá ovato-oblongá, longitudinaliter costatá, transversim sulcatá; spirá mediocri,

apice acuto: anfractibus ventricosis, biná serie spinarum armatis; spatio inter series concavo: aperturá ovato-elongatá, in medio effusá, anticè parum coarctatá; labro tenui, simplici; labio expanso, posticè incrassato; columellá leviter arcuatá, bis vel ter plicatá.

Shell oblong, ventricose, longitudinally ribbed, transversely furrowed; spire moderately elevated, with a small pointed apex; the ribs, which are more or less numerous in different specimens, extend over nearly the whole length of the whorls, and terminate posteriorly in a row of erect, sharp spines. Close to the edges of the whorls rises a second row of smaller spines, the space between it and the suture forming a channel round the spire more or less deep, according to the height of the spines. The two rows of spines are connected by raised lines, and the intermediate space is concave. On the last whorl or two of the fully formed shell, the second row of spines frequently becomes obsolete, and is replaced by a sharp, elevated ridge. The furrows, in young specimens, extend over the whole surface of the whorl, but, as the shell advances towards maturity, the posterior ones become faint, and at length are frequently almost obliterated. The mouth is contracted in front, effuse near the middle, and deeply notched at the base. The outer lip is in all stages of growth thin, sharp-edged, and quite smooth within; the columellar lip is moderately spread out over the body whorls, and thickened behind, and does not extend backwards beyond the suture. The columella, which is slightly arched, presents in the young state, two unequal, not very oblique plaits, in front of which a third obscure plait generally appears at maturity.

Brander's shell (fig. 65), referred by Solander to *V. luctatrix*, and by Lamarck to *V. spinosa*, presents nevertheless characters sufficiently distinct to entitle it, as Mr. Sowerby long ago suggested, to be considered as belonging to a separate species. In addition to the distinction afforded by the rows of spines, which are more equal and more permanent in this species than usual, it will be seen, on comparison with *V. luctatrix*, that in *V. Solandri* the shell is shorter and broader, the spire not so much elevated, the outer lip always sharp edged, and without plication, the inner lip not so effuse, the columella arched, and the columellar folds neither so numerous nor so large; and, on a comparison with *V. spinosa*, that the shell is not so turbate, the spire more elevated, and the whorls more ventricose.

Size.—Axis, 2 inches nearly; diameter, rather more than 1 inch.

Locality.—Barton.

No. 94. *VOLUTA SCALARIS*. Sowerby. Tab. XX, figs. 5 a—c.

VOLUTA SCALARIS, Sow. 1843. Min. Con., vol. vii, p. 32; t. 625, fig. 4—5.

V. testá ovatá, ventricosá, anticè attenuatá; spirá elevatá, apice acuminato: anfractibus costatis, biná serie spinarum coronatis, transversim sulcatis, ad margines suturales depressis, inter series spinarum concavis; costis numerosis; sulcis sub-distantibus, aequalibus: labro simplici, acuto; labio parum expanso; columellá sub-rectá, triplicatá.

Shell ovate, very ventricose, much attenuated and deeply notched in front; spire elevated; apex pointed. The whorls, six or seven, longitudinally ribbed, transversely furrowed; ribs numerous and sharp in young specimens, more distant and rounded in mature shells, and crowned with a double row of erect, sharp, nearly equal spines; the furrows, which are rather distant and regular, extend up to the front row of spines, but in fully formed shells often become obliterated over the posterior part of the last whorl. A narrow flat border runs round the whorls between the suture and the second row of spines, and the space between the two rows is concave. The outer lip is thin, sharp, and quite smooth within; the inner lip is not much spread out, and does not extend backwards beyond the suture; the columella, which is slightly curved, presents three folds.

This shell so closely resembles *V. Solandri* that it may, perhaps with greater propriety, be regarded as a dwarf variety of that species, rather than as being distinct from it. It is, however, more ventricose, with a longer spire and more nearly equal spines: the inner lip is less spread over the ventral surface of the body whorl, and the notch is not so deep.

The species occurs in abundance at Highcliff, but in the specimens from that locality the spines are blunt, almost nodiform, and the furrows more numerous. The same variety occurs at Alum Bay, and occasionally, though rarely, at Barton.

Size.—Axis, 1 and 2-10ths of an inch nearly; diameter, 7-10ths of an inch.

Localities.—Barton, Highcliff, Alum Bay (Strat. No. 29, Prestwich).

No. 95. *VOLUTA RECTICOSTA*. Sowerby. Tab. XX, fig. 3.

VOLUTA RECTICOSTA. Sow. 1850. Dixon's Geol., &c., of Suss., p. 188; t. 5, fig. 18.

V. testā ovato-oblongā, costatā, transversim sulcatā, anticē subrostratā, parum emarginatā; spirā mediocri apice acuto: anfractibus ventricosis, duplici serie spinarum coronatis; spatio inter series spinarum concavo; costis numerosis, rectis, tenuibus, primam seriem spinarum gerentibus; labro tenui.

Shell oval-oblong, ribbed, transversely furrowed; spire moderately elevated, terminating in a small pointed apex; whorls ventricose, contracted rather suddenly in front, so as to give a beak-like form to the base, crowned with two not very distant rows of short, erect, sharp spines; ribs numerous, thin, straight, scarcely extending beyond the middle of the whorl, and each terminating in a spine; the margins of the whorls between the two rows of spines concave. The outer lip thin, sharp edged, and smooth within. The basal furrows are strongly marked, and extend higher up the whorl than is usually the case. The notch in front is not deep.

The figure is taken from the original specimen described and figured by Mr. Sowerby; this specimen, which forms part of Mr. Dixon's collection, is unfortunately somewhat crushed and distorted. No traces of the inner lip remain, and the aperture

is filled with the matrix, so that the columellar folds cannot be seen. Mr. Sowerby, in his description, expressed an opinion that this shell might probably be the same as *V. ambigua* (Lamk.); the two rows of spines and the hollow space between them, however, appear to distinguish it. I am more inclined to refer it to *V. scalaris*, or to regard it as a young shell of *V. solandri*; but the short spire, numerous straight ribs, and the deep basal furrows distinguish it apparently from the former; while these characters, as well as the general form of the shell, which is more ventricose and more contracted in front than in *V. solandri*, appear to separate it from the latter species. A young specimen from Stubbington, in M. D'Urban's collection, presents the same characters as the one figured; and additional specimens may establish the species; in the meantime I retain it, but with some doubt.

Size.—Axis, 1 inch and 2-10ths; diameter, 6-10ths of an inch.

Localities.—Bracklesham Bay, Stubbington.

No. 96. *VOLUTA SUSPENS*A. *Solander*. Tab. XX, figs. 4 *a—c*.

MUREX SUSPENSUS. *Soland*. 1766. Brand. foss. Hanton., p. 32; t. 5, fig. 70.

VOLUTA CRENULATA. *Webster*. 1814. Geol. Trans., 1st series, vol. ii, p. 204.

— *AMBIGUA*, VAR. *MONSTROSA*. *Sow*. 1816. Min. Con., vol. ii, p. 31; t. 115, fig. 5.

— *SUSPENS*A. *Sow*. 1823. Min. Con., vol. iv, p. 137.

V. testá orato-oblongá, sub-turritá, costatá, transversim sulcatá, ad basin sub-productá, parum emarginatá; spirá elevatá, acuminatá, canali lato, marginibus anfractuum repente inflexis septo, circumdatá: anfractibus sub-ventricosis, dentato-crenatis; costis obscuris, distantibus, und serie spinarum coronatis: aperturá postice acute angulatá, antice coarctatá; labro simplici tenui; columella buplicatá.

Shell oval-oblong, turreted, ribbed, transversely furrowed; spire elevated, pointed; whorls somewhat ventricose, the posterior margins suddenly bent inwards, forming round the spire a broad deep canal, bounded by a sharp denticulated ridge. The ribs, numerous in the young shells, but becoming more distant towards maturity, extend nearly to the base of the whorl, and terminate posteriorly in sharp, tooth-like spines. At the posterior extremities of the ribs, the whorl is depressed, and presents a narrow flat space, which forms, as it were, a platform from which the sharp ridge bounding the spiral canal rises. The furrows at the base are broad and rounded; the others distant and angular. The aperture is contracted, and produced in front, wide in the middle, sharply angulated behind; the outer lip thin and smooth within: the columella nearly straight, presenting two very unequal folds.

This is the rarest of the Barton Volutes; it may be readily distinguished by the broad deep channel which runs round the spire.

Size.—Axis, 3 inches; diameter, 1 inch and 6-10ths.

No. 97. *VOLUTA TRICORONA*. Sowerby. Tab. XX, figs. 7 *a—d*.*VOLUTA TRICORONA*. Sow. 1843. Min. Con., vol. vii, p. 6; t. 613, fig. 2.

V. testá ovato-rhomboidali, costatá, transversim sulcatá, antice profunde emarginatá: spirá brevi, apice acuto; anfractibus obtusangulatis, triplici serie spinarum nodiformium coronatis; costis numerosis, angustis, fere ad basin tendentibus; sulcis transversis irregularibus, lineis incrementi decussatis: aperturá elongato-ováli, postice subcanaliculatá; labro simplici, lævi; labio effuso; columellá buplicatá.

Shell rhomboidal-ovate, longitudinally ribbed, transversely furrowed; spire short, apex small, pointed: whorls bluntly angulated at the shoulder; ribs rather numerous, narrow, extending almost to the base, and surmounted by three rows of short nodiform spines; furrows rounded, shallow, crowded and irregular on the posterior part of the whorl, deep, distant, and regular towards the base; decussated by thick conspicuous lines of growth: aperture of a lengthened ovate shape, deeply notched in front, and terminating behind in a short, wide canal; outer lip thin, smooth within; columella nearly straight, flattened on the anterior surface, and furnished with two folds, of which the front one is thick and very oblique. Only imperfect traces of the inner lip remain in the specimens I have seen, but it was apparently widely spread, covering the front of the body whorl, and stretching backwards far up the spire.

This Volute, which appears to be peculiar to the lower formations, is very rare. In the general form it resembles *V. denudata* so much that a worn individual might easily be mistaken for one of that species. The *V. denudata* is, however, distinguished by its single row of thick nodiform tubercles, the rounded dome-like shape of the posterior margin, and the smooth upper surface of the body-whorls. Fig. 7 *d* is taken from the original specimen figured in 'Mineral Conchology.' This, and also the specimens represented by figs. 7 *a, e*, form part of Mr. Wetherell's collection.

Size.—The largest specimen I have seen has lost the upper part of the spire, but when perfect, the dimensions would have been, axis, 2 inches, nearly; diameter 1 and 1-10th of an inch.

Localities.—Primrose Hill, Copenhagen Fields, Potter's Bar.

No. 98. *VOLUTA PUGIL*. F. E. Edwards. Tab. XXII, figs. 1 *a—c*.*VOLUTA SPINOSA*. Sow. 1850. Dixon's Geol., &c., of Suss., p. 107; t. 5, fig. 16.— — var. *PLATYSPINA*. Sow. 1850. Dixon's Geol., &c., of Suss., p. 107; t. 7, fig. 29.

V. testá ovato-oblongá, antice attenuatá, obscure costatá, transversim sulcatá; spirá brevi, apice acuto: anfractibus convexiusculis, unicá serie spinarum coronatis; spinis magnis, dis-

pansis; sulcis transversis distantibus, ad basin latis, profundis: aperturá postice sub-canaliculatá, antice late emarginatá; labro tenui, simplici; labio effuso, postice incrassato; columellá arcuatá, quater vel quinquies plicatá.

Var? PLATYSPINA, fig. 1 c. *Testá tuberculis nodiformibus, crassis, lateraliter compressis, coronatá.*

Shell ovately oblong, contracted at the base, obscurely ribbed, transversely furrowed, with a short, rather conical, and pointed spire: whorls angulated at the shoulder, and crowned with a single row of large, wide-spreading spines. The bases of the spines are prolonged into thick, obscure ribs, which do not extend beyond the middle of the whorls. In the young state, the ribs are numerous, and surmounted by two rows of small, sharp spines; as the shell increases in size, the ribs become more distant, and the row of spines nearest to the suture disappears, and is replaced by a sharp, elevated ridge. The transverse furrows are distant, and broad and deep at the base. The aperture is contracted in front, obscurely channelled close to the suture, and widely, but not deeply, notched in front; outer lip thin, sharp edged, and smooth within; inner lip widely spread, thickened posteriorly, and extending backwards as far as the suture; columella flattened in front, curved, and furnished with four or five folds, of which the one in front is the largest. In the last whorls, the sutural margin is spread over the preceding whorl up to the spines, which, in some instances, are covered by it.

In the specimen represented by fig. 16, tab. 5, in Mr. Dixon's work, the outer lip is broken off, and the shell consequently presents the turbate form which characterises *V. spinosa* (Lamk.); and this circumstance probably induced Mr. Sowerby to refer it to that species; from which, however, it is distinguished by the transverse furrows, and the arched and flattened columella.

In the specimen (fig. 1 c) for which the variety *platyspina* was proposed by Mr. Sowerby, the spines on the last whorl are converted into large, thick, laterally-compressed, knob-like tubercles. The animal had, apparently, attained great age; and, as I am not aware of any similar specimen having been found, I am inclined to regard the individual in question as a monstrosity rather than as a variety.

The present shells much resemble *V. athleta* in the character of the spines, and in the conditions of the inner lip and the columellar folds; but the deep transverse furrows, which continue to be strongly marked even in adult specimens, entitle them, apparently, to specific distinction.

Size.—Axis, ; diameter,

Locality.—Bracklesham Bay.

Section A. (*Pullus* small, conical.

a. *Shell turbinate or pyriform; costated or coronated; inner lip effuse; columellar plaits few.* } continued.

β. *Transversely furrowed at the base only.*

No. 99. VOLUTA ATHLETA. *Solander*. Tab. XXI, figs. 7 a—e.

STROMBUS ATHLETA.	<i>Soland.</i> 1766. Brand. Foss. Hanton., p. 31; t. 5, fig. 66.
VOLUTA —	<i>Sow.</i> 1823. Min. Con., vol. iv, p. 133; t. 396, figs. 1—3.
— —	<i>Defr.</i> 1829. Dict. des Sci. nat., vol. lviii, p. 480.
— —	<i>Desh.</i> 1824-37. Desc. des coq. foss., vol. ii, p. 689; t. 93, figs. 12—13.

V. testá rhomboidali, spinis magnis dispansis coronatá, ad basin sub-profunde emarginatá; spirá brevi, acuminatá: anfractibus postice lævibus, ad basin obsolete transversim sulcatis: aperturá effusá; labro tenui, simplici; labio parum effuso, postice incrassato; columellá depressá, leviter arcuatá, tri-plicata.

Var. FORTIS (tab. 21, fig. 7 e) testá ovato-turbinatá, breviori, latiori; anfractibus antice valde attenuatis.

Shell rhomboidal, crowned with large spreading spines, and widely, but not deeply, notched at the base; spire rather short and pointed. In young individuals, the whorls are transversely furrowed, obscurely ribbed, and surmounted by two rows of short, erect spines; but as the shell approaches maturity, the ribs become effaced, the second, or sutural row of spines disappears, and is replaced by an irregular sharp elevated line, and the spines of the first row become large, distant, and spreading; the transverse furrows disappear after the first three or four whorls, and the shell is afterwards smooth, except at the base, where a few faint, almost obsolete, transverse furrows appear. The aperture is elongate, and rather wide; the outer lip smooth and simple; the inner lip moderately spread over the body whorl, thickened at the upper part, and not extending backwards beyond the suture; columella flattened in front, slightly curved, and presenting one broad prominent fold in front, and two or three others, small and indistinct, behind.

A variety occurs at Highcliff, which appears to correspond with the shell described by M. Deshayes, more closely than do the Barton shells; it is more turbinate, shorter, and comparatively wider than the type, and the whorls are much attenuated in front.

The smooth and ventricose body and flattened columella distinguish this species; and at maturity, the large spreading spines give a strongly marked character to it.

Size.—Axis, 3 inches, nearly; diameter, 1 inch and 7-10ths, nearly.

Localities.—Barton, Alum Bay (No. 29, Prestwich). For the variety, Highcliff. *French*: Monneville, Houdan (fide Desh.).

No. 100. *VOLUTA DENUDATA*. *Sowerby*. Tab. XXI, figs. 5 *a—c*.*VOLUTA DENUDATA*. *Sow.* 1840. *Min. Con.*, vol. 7, p. 6; t. 93, fig. 3.— — — 1850. *Dixon's Geol. Suss.*, p. 120; t. 15, fig. 7.

V. testá ovato-oblongá, postice lævi, antice transversim sulcatá, profunde emarginatá; spirá conicá, brevi, apice acuto; costis brevibus, crassis, ad extremitates posteriores nodigeris; anfractu ultimo superne concamerato: aperturá elongato-ovali, postice angustá; labro simplici, intús lævi; labio expanso, incrassato; columellá tri-plicatá.

Shell oblong-ovate, ribbed, smooth, except towards the base, where it is transversely furrowed; spire short, conical; apex small, pointed; ribs thick, short, scarcely extending to the middle of the whorl, and terminating posteriorly in coarse, nodiform tubercles; whorls rather ventricose in front, obtusely angulated at the shoulders; the space between the tubercles and the suture convex, imparting a dome-like shape to the lower part of the spire. The aperture is of a lengthened oval form, narrow, obscurely channelled behind, widely and deeply notched in front; the outer lip simple, smooth within; inner lip much spread over the front of the body whorl, extending backwards far up the spire, and thickened. The columella is flattened in front, and presents one thick, prominent fold in front, and two or three smaller ones behind. In the young shell, the whorls are crowned with three rows of small, nodiform spines, and the margins between the front row and the suture are somewhat depressed. The two posterior rows, which correspond with the front row, rise out of faint, elevated lines, which traverse the sutural margin; as the shell is enlarged, these spines are lost, and the transverse lines become stronger; the direction of the suture also becomes less decurrent, so that each succeeding whorl envelops more of the preceding one, and the margin of the last, in fact, covers the front row of spines upon the whorl next to it; the margins also become convex, and assume the dome-like shape characteristic of the later whorls.

Size.—Axis, 3 inches, nearly; diameter, 1 and 7-10ths of an inch, nearly.

Localities.—Bognor, where it is very common, and (*vide Sow.*) Brentford.

No. 101. *VOLUTA SPINOSA*. *Linnæus*. Tab. XXI, figs. 4 *a, b*.

Lister. *Hist. Conchyl.*, t. 1033, fig. 7?

Gualtieri. 1742. *Index Test. Conch.*, t. 55, fig. E?

CONUS SPINOSUS. *Linn.* 1758. *Syst. Nat.*, 10th edit., p. 715, No. 271.

BUCCINUM (SP.) *Walch.* 1764. *Das Steinreich System.*, &c., t. 11, fig. 2 *a*.

STROMBUS SPINOSUS. *Linn.* 1767. *Syst. Nat.*, 12th edit., p. 1212.

— — *Favanne*. 1780. *D'Argen. Conchyl.*, 3d edit., t. 66, fig. I, 9.

— — *Schröter*. 1783. *Einleit. in die Conch.*, vol. 1, p. 443, No. 24.

— — *Gmel.* 1788. *Linn. Syst. Nat.*, 13th edit., p. 3518, No. 27.

STROMBUS SPINOSUS. *Chemn.* 1795. *Conchyl. cab.*, vol. xi, t. 212, figs. 3002—3.

VOLUTA SPINOSA. *Lam.* 1802. *Ann. du Mus.*, vol. i, p. 477, No. 2, and vol. xvii, p. 74, No. 2.

- — *Roissy.* 1804. *Buff. Moll.*, vol. v, p. 440, No. 7.
- — *Lam.* 1816. *Tableau Encyclop. et Méth.*, t. 392, fig. 5 *a—b*.
- — — 1822. *Hist. Nat.*, vol. vii, p. 348, No. 2.
- — *De France.* 1829. *Dict. des Sci. Nat.*, vol. lviii, p. 474.
- — *Desh.* 1832. *Encycl. Méthod. (Vers)*, vol. iii, p. 1143, No. 22.
- — — 1824—37. *Desc. des Coq. Foss.*, vol. ii, p. 690; t. 92, figs. 7—8.
- — ? *Galeotti.* 1837. *Mém. sur la Const. Géog., &c., de Brabant*, p. 149, No. 71, t. iii, fig. 16.
- — ? *Nyst.* 1843. *Coq., &c., de Belg.*, p. 589.
- — *Morris.* 1843. *Cat. Brit. Foss.*, p. 168.
- — ? *Philippi.* 1851. *Palæontogr. Tert. Foss. Magdeb.*, p. 78, No. 169.
- Nec. — — *Sow.* 1816. *Min. Con.*, vol. ii, p. 30; t. 115, figs. 2—4.
- nec. — — — 1850. *Dixon's Geol., &c., of Suss.*, p. 107; t. 5, fig. 16.
- nec. — — var. *PLATYSPINA.* *Sow.* 1850. *Dixon's Geol., &c., of Suss.*, p. 107; t. 5, fig. 29.

V. testá turbinatá, ad basin transversim striatá, longitudinaliter partim costatá; anfractibus acute angulatis, unicá serie spinarum coronatis; spirá brevi, apice acuto; labro tenui, simplici; columellá quadri-plicatá.

Shell turbate, resembling in shape two unequal cones placed base to base, the smaller of which is formed by the short pointed spire; whorls nearly straight, longitudinally ribbed, much narrowed in front, and acutely angulated at the shoulder; the margin between the spines and the suture rather concave. The ribs, which extend only about half-way over the whorl, terminate at the shoulder in a row of short, pointed spines. The sutural margin is bordered by an elevated line, which, occasionally, in young shells, rises into small, pointed tubercles opposite to the spines. The whorls at the base are traversed by several oblique furrows, which disappear towards the middle of the shell, where the ribs take their rise. The mouth is narrow, and somewhat quadrilateral, owing to the angularity of the upper part of the whorl; the outer lip thin and smooth within; inner lip but little spread out. The columella, which is rather flattened in front and nearly straight, presents one large prominent plait in front, and three, sometimes four, feeble ones behind and, according to M. Deshayes, a large smooth callus at the posterior extremity formed by the thickening of the inner lip.

The shells from Barton, described by Mr. Sowerby (*loc. cit.*), and referred by him to this species, present characters sufficiently distinct, as I have before observed, to require that they should be separated. I have not met, in fact, with any shell from the Hampshire beds corresponding with the true *V. spinosa* of the Paris basin, unless the *V. depauperata* be regarded as a local variety; but the species occurs not unfrequently at Bracklesham Bay.

The French specimens are generally ornamented with numerous pale orange-coloured bands; but the English matrix has been less favorable for the preservation of the colouring matter, and specimens retaining traces of the original marking are very rare.

The shells described in Mr. Dixon's work as *V. spinosa*, and *V. spinosa*, var. *platyspina*, (p. 107, t. 7, f. 22,) do not belong to this species; nor, apparently, do those described by Galeotti from St. Josse-ten-Noode, St. Gilles, Forêt, and Afflighem in Brabant; in them, the ribs are thick, round, and prominent; and the whole surface presents a transverse sculpture. Philippi records a specimen of the present species from Westeregeln, in the Museum at Halle; but as Dr. Beyrich does not mention the species among the Volutes described by him from that locality, I have cited Philippi with a query.

Size.—Axis, 1 inch and 3-10ths; diameter, nearly 8-10ths of an inch.

Localities.—Bracklesham Bay; Southampton. *French*: Grignon, Courtagnon, Parnes. *German*: Westeregeln in Magdeburg (fide Phil.)?

No. 102. *VOLUTA DEPAUPERATA*. *Sowerby*. Tab. XXI, figs. 8 *a—c*.

VOLUTA DEPAUPERATA, *Sowerby*. 1823. Min. Con., vol. iv, p. 133, t. 396, fig. 4; vol. vii, p. 32, t. 625, fig. 6.

—	—	<i>Defr.</i> 1829. Dict. des Sci. nat., vol. lviii, p. 481.
non	—	<i>Desh.</i> 1824-37. Desc. des coq. foss., &c., vol. ii, p. 684, t. 92, figs. 5, 6.

V. testá ovato-oblongá, partim costatá, antice transversim sulcatá, postice lævi; spirá brevi, apice acuto; anfractibus sub-ventricosis, postice acute angulatis, uná serie spinarum donatis, margine suturali sub-convexo: labro simplici, tenui; labio parum expanso; columellá buplicatá.

Shell oval-oblong, longitudinally ribbed, transversely furrowed in front, otherwise smooth, with a short pointed spire: whorls rather ventricose, acutely angulated at the shoulder. The ribs, which are not numerous, extend over about two thirds of the whorl, and terminate at the shoulder in a row of short erect spines. In young shells a second row of small pointed tubercles, corresponding with the spines, runs round the suture; but they soon disappear, and generally are replaced by an irregular raised line. The margin of the whorls, between the shoulder and the suture is slightly convex. The aperture is of a lengthened-oval shape, rather effuse and widely but not very deeply notched in front; the outer lip thin and smooth; the inner lip but slightly spread out; the columella rounded, nearly straight, and furnished with two unequal folds. The surface of the shell is ornamented with transverse, narrow, orange-coloured bands, resembling those

in the French specimens of *V. spinosa*, with which species the present one is closely analogous, and of which it appears to me to be merely a local variety. It is in fact, only distinguished by the more ventricose whorls, the more effuse aperture, the rounded columella, and the greater obliquity of the columellar folds.

Brander's shell (fig. 67), referred by Mr. Sowerby to this species, belongs to *V. luctatris*; and the French shells which M. Deshayes has described as *V. depauperata* also appear to be quite distinct; they are longer, narrower, and more regular in form, and have a more elevated and thicker spire; and the surface of the whorl is obscurely striated.

Size.—Axis, 1 inch and 9-10ths; diameter, not quite 1 inch.

Localities.—Barton (fig. 8 *a*), and the fluvio-marine formation at Hordwell, and at Colwell Bay (figs. 8 *b*, *c*), in which latter place it occurs in abundance.

No. 103. *VOLUTA GEMINATA*. Sowerby. Tab. XXI, figs. 3 *a*, *b*.

VOLUTA GEMINATA, Sow. 1823. Min. Con., vol. iv. p. 136; t. 398, fig. 1.

V. testá ovatá, ventricosá, antice coarctatá, costatá, sub-turritá; spirá mediocriter elevatá, apice acuto; anfractibus postice lævibus, ad basin transversim sulcatis, ad margines suturales depressis; costis pro-eminentibus, sub-crassis, postice biná serie spinarum nodiformium coronatis; aperturá oblongo-ovali, antice angustiori; labro tenero, simplici; labro late expanso, postice incrassato; columellá arcuatá, tri-plicatá.

Shell ovate, ventricose, contracted towards the base, ribbed; spire moderately elevated, apex very small, pointed; whorls five or six, smooth on the middle and at the posterior extremities, transversely furrowed toward the base, and flattened at the sutural margin; ribs prominent, rather thick, rounded, extending to the transverse furrows, and surmounted by two rows of short, erect, connected, nodiform spines, with a rounded, depression between them; the flattened margins of the whorls form a shallow obscure channelled round the spire, imparting to it a turret-like aspect. The aperture is of a lengthened-oval shape, narrowing toward the base; the outer lip thin, sharp, and smooth within; the columellar lip much spread out over the body-whorl, but not extending backwards beyond the suture; the columella much curved, and furnished with three oblique folds.

The present species appears to be confined to the neighbourhood of Lyndhurst, where it was first discovered many years ago by Sir Charles Lyell.

Size.—Axis, rather more than 1 inch and 3-10ths; diameter, 7-10ths of an inch, nearly.

No. 104. *VOLUTA HORRIDA*. *F. E. Edwards*. Tab. XXI, figs. 2 *a—c*.

V. testá oblongo-ovatá, costatá, postice lævi, antice transversim sulcatá; anfractibus duplici serie spinarum dentiformium donatis; costis numerosis, lateraliter compressis, fere ad basin tendentibus, postice tuberculatis et in mucrones primam seriem spinarum formantes, prolongatis; sulcis transversis latis, profundis, costas fortiter decussantibus; spatio inter series spinarum concavo; labro tenui, simplici; columellá uniplicatá.

Shell ovate-oblong, armed with two rows of short, upright, pointed spines, ribbed, smooth behind, transversely furrowed in front; ribs numerous, thick, angular, compressed sideways toward the aperture and terminating posteriorly in sharp conical points forming the front row of spines. The ends of the ribs, immediately in front of the spines present a rounded depression at the anterior margin of which they rise into small tubercles. The transverse furrows are wide and deep, strongly decussating the ribs. The posterior margins of the whorls, between the rows of spines, are sunken and concave; the outer lip is thin, sharp-edged, smooth within?; the columella presents a single very oblique fold.

The sharp erect conical spines and the prominent ribs, deeply cut by the transverse furrows are characters so distinct, that I am unwilling not to record the species, although the only specimen I possess has lost the spire and is otherwise imperfect. It appears to be a young shell, and the actual character of the outer lip cannot be stated with certainty; there are not any traces of the columellar lip preserved.

Size.—Axis, (without the spire) $\frac{1}{2}$ inch, nearly; diameter, rather less than 3-10ths of an inch.

Locality.—Bracklesham Bay; very rare.

No. 105. *VOLUTA FORBESII*. *F. E. Edwards*. Tab. XXI, figs. 1 *a—d*.

V. testá turbinatá, costatá, postice lævi, antice transversim sulcatá; spirá elevatá, apice acuto; costis sub-distantibus, vix ad sulcos tendentibus, postice in tuberculos lateraliter compressos elevatis, deinde biná serie brevium spinarum coronatis; aperturá elongato-ovali, angustá, postice sub-canaliculatá, antice late emarginatá; labro intús incrassato, ad marginem acuto; labio effuso; columellá rectá, biplicatá.

Shell turbate, ribbed, transversely furrowed at the base, smooth behind; spire elevated, pointed, with a small conical apex; ribs rather distant, extending scarcely beyond the middle of the whorls, rising at the posterior extremities into large, prominent, laterally compressed tubercles, and crowned with a single row of short, erect, tooth-like spines. The sutural margin is depressed and bordered by a raised line, which occasionally rises into minute pointed tubercles; aperture of a lengthened oval form,

narrow, obscurely channelled behind, and widely notched in front; the outer lip thickened within, thin and sharp at the edge; inner lip moderately spread over the body-whorl, and presenting at the suture a callus-like thickening, which forms the left side of the posterior canal; the columella nearly straight, and furnished with two or three not very oblique folds, the front one of which is the most prominent.

The present species approaches closely to *V. geminata*, but is much more turbinate, resembling in general form *V. spinosa*; and the anterior tubercles are different in their character; in the present species they are simply an enlargement of the ribs themselves, while in *V. geminata*, a transverse line runs round the shoulder, and rises into tubercles where it crosses the ribs; the aperture in *V. Forbesii* is also narrow and more regularly ovate. This species is found in Hempstead Cliff; and I have dedicated it to the late much lamented Prof. E. Forbes, by whose researches the position of that formation in the tertiary series, so long misunderstood, has been ascertained.

Size.—Axis, 7-10ths of an inch; diameter, 4-10ths of an inch.

No. 106. *VOLUTA CALVA*. Sowerby. Tab. XXI, figs. 6 *a*, *b*.

VOLUTA CALVA. Sow. 1850. Dixon's Geol., &c., of Suss., p. 187; t. 7, fig. 28.

V. testá pyriformi, antice transversim obsolete sulcatá, cæterum laevi, ad basin vix emarginatá; spirá brevi, conicá, apice acuto: anfractibus angulatis, unicá sine spinarum donatis, superne concavis, marginibus anfractu precedenti adpressis: aperturá elongato-ovali, labro tenui, simplici; labio parum effuso; columellá subrectá, bis vel ter plicatá.

Shell pyriform, obscurely ribbed, slightly notched at the base, and presenting several faint, almost obsolete, transverse furrows in front, smooth elsewhere; spire short, conical, with a small pointed apex: whorls angulated at the shoulder, and crowned with a single row of short, pointed tubercles; the margins pressed against the spire; the space between the suture and the row of tubercles concave. The aperture of a lengthened oval shape; outer lip thin, sharp-edged, smooth within; inner lip very thin and but little spread out; and the columella furnished with two nearly equal folds in front, and a third very feeble one behind.

The specimens are generally simply coronated; but, in some instances, the elevated bases of the tubercles are prolonged into very short, faint ribs. The angulated shoulder and the tubercles distinguish this species from the young shell of *V. Selseiensis*, with which only it might be confounded.

Size.—Axis, $1\frac{1}{2}$ inch, nearly; diameter, 7-10ths of an inch.

Locality.—Bracklesham Bay, where it is somewhat rare.

No. 107. *VOLUTA SELSEIENSIS*. *F. E. Edwards*. Tab. XXII, figs. 3 a—f.

VOLUTA LABRELLA. *Sow.* 1840. *Min. Con.*, vol. vii, p. 8; t. 614, fig. 2.

— — *Morris*. 1843. *Cat. Brit. Foss.*, p. 167.

— — *Sow.* 1850. *Dixon's Geol., &c., of Suss.*, p. 187; t. 5, figs. 12—14.

BULBULA. — — — — — p. 186; t. 7, fig. 35.

nec. — *LABRELLA*. *Lamk.* 1802. *Ann. du Mus.*, vol. i, p. 479, No. 10, vol. xvii, p. 74, No. 14.

nec. — *BULBULA*. *Lamk.* 1802. *Ann. du Mus.*, vol. i, p. 479, No. 11.

V. testá ovato-turbinatá, ventricosá, antice transversim sulcatá, cæterum lævi; spirá brevi, conicá, apice acuto: anfractibus prioribus costas et sulcos transversos, sese decussantes, gerentibus; anfractibus cæteris unico sulco transverso prope margines suturales exaratis, marginibus ad spiram adpressis; peripheriá anfractuum primo convexá, deinde gradatim plus plusque rotundatá: aperturá elongato-rhomboidali, antice profunde emarginatá, postice sub-canaliculatá; labro postice incrassato, antice acuto, lævi; labio parum effuso, incrassato, postice magnum callum oblongum, anfractum a spirá separantem, formanti; columellá leviter arcuatá, compressá, biplicatá.

Shell ovately turbinate, ventricose; spire short, conical, with a small, pointed apex; the first two or three whorls ornamented with numerous slender longitudinal ribs decussated by transverse furrows, which disappear rather suddenly at the third whorl; the whorls then become perfectly smooth, except towards the base, where they are traversed by broad more or less conspicuous furrows. The aperture is of an elongated rhomboidal form, deeply notched in front, and terminating posteriorly in an obscure channel; the outer lip smooth within, thickened behind, and stretching outwards into a wing-like projection; the middle and front parts thin and sharp-edged; the columellar lip but little spread out, and very much thickened, forming at the posterior extremity a large callus, which gradually separates the margins of the whorls more and more widely from the spire; the columella is curved, flattened, and furnished with two oblique, nearly equal folds, and sometimes with a third feeble and indistinct one behind. The middle whorls are convex at the shoulders, but as they become more and more detached from the spire by the increasing callus, the shoulders become more and more bluntly round.

The shells referred by Mr. Sowerby to *V. bulbula* are without doubt the young of the present species; but even in this state (figs. 2 a, b), although they much resemble the French shells, they present dissimilarities which sufficiently indicate a distinct species. In *V. bulbula*, the shell is more fusiform, with a longer spire; the margins of the whorls are without the transverse furrow; the outer lip, even in the adult shell, is not thickened; the inner lip is very thin, more widely spread over the body-whorl, and without the thickening or callus which distinguishes the present species; the columella is nearly straight and round; the folds are more slender, and placed nearer the middle of the

columella, and the basal furrows are fainter and more numerous, becoming, in fact, almost obsolete on the mature shell.

The present species certainly presents a close analogy with *V. labrella* (Lamk.) to which the adult shells have been referred; but a careful comparison will show, I think, that they are not a mere local variety of that species, but distinct from it. In *V. Selseiensis*, the whorl is more convex, and the general form of the shell is consequently more ovate and less turbate; the shoulder is always obtusely rounded, and never presents the prominent keel which characterises *V. labrella*, nor even the angular periphery which, in some specimens, is substituted for the keel; the transverse furrows are lost after the very early whorls, while in the French species they are continued more or less distinctly until maturity. But the principal differences will be found in the condition of the lips; for in *V. labrella*, the outer lip is much less thickened, and does not assume the wing-like expansion found in the present species; the inner lip is more widely spread over the front of the body-whorl and, although thickened at the posterior extremity, does not form the large callus which, by separating the margin of the whorl from the spire, forms so conspicuous a character in *V. Selseiensis*.

Size.—Axis, 2 inches and 7-10ths nearly; diameter, rather more than 1 inch and 6-10ths.

Locality.—Bracklesham Bay, where it is not uncommon.

Section A. (Pullus small, conical) continued.

b. Shell fusiform; costated, transversely striated; inner lip narrow.

a. Columellar plaits few.

No. 108. *VOLUTA ANGUSTA*. Deshayes. Tab. XXIII, figs. 3 *a*, *b*.

VOLUTA ANGUSTA, Desh. 1824-37. Desc. des Coq. Foss., vol. ii, p. 697; t. 94, figs. 5, 6.

— — Sow. 1844. Min. Con., vol. vii, p. 34, t. 626, figs. 1—3.

— — Sow. 1850. Dixon's Geol., &c., of Suss., p. 107, t. 5, fig. 19 (non t. 7, fig. 37).

V. testá elongatá, sub-fusiformi, angustá, costatá, ad basin late emarginatá; spirá productá sub-conicá, apice acuto: anfractibus depresso-convexiusculis, superne tenuissime striatis; ultimo anfractus spiram longitudine fere æquantis; postice tuberculoso-costatá, ad basin levi: aperturá elongatá, angustá; columellá rectá, obscure triplicatá; labro acuto, simplici; labio angusto.

Shell fusiform, much elongated, narrow, ribbed, and widely but not very deeply notched at the base; spire conical, produced, nearly as long as the last whorl; apex small, pointed: whorls depressedly convex, ornamented with exceedingly fine transverse striæ; ribs distant, not prominent, extending to nearly the middle of the whorl, and

rising at the shoulder into obtuse laterally compressed tubercles; the transverse striae are lost on the middle and front parts of the last whorl, and are only faintly traceable towards the sutural margin. The aperture is elongated, narrow, with nearly parallel margins; the outer lip simple, sharp-edged, angular at the posterior extremity, smooth within; inner lip narrow; the columella is nearly straight, and, according to M. Deshayes, is furnished with three folds, of which one only is visible in front, but the other two are seen when the outer lip is broken.

The much-varying forms of *V. muricina*, suggested to M. Deshayes the probability that this might eventually prove to be merely a narrow variety of that species, to which in fact it bears a very strong resemblance: the transverse striation is common to both species, and much value, cannot, I think, be attributed to the greater or less number of the feeble posterior columellar folds. I should be strongly inclined, therefore, to regard this as a variety of *V. muricina*, were it not for the difference in the size of the pullus, which, in *V. angusta*, is much smaller than in *V. muricina*; and, as it is uncertain how far external conditions may influence the development of the shell in embryo, I have retained the species.

The shell represented in Mr. Dixon's work, t. 7, fig. 37, does not, in my opinion, belong to this species; for the pullus, though small, is obtuse, not conical and pointed; and the notch is very deep: it is, I think, a large specimen of *V. uniplicata*.

Size.—Axis, 3 inches nearly; diameter, 9-10ths of an inch.

Localities.—Bracklesham Bay. *French*: Rétheuil, Soissons, Cuise-Lamotte, (fide Desh.)

No. 109. *VOLUTA COSTATA*. *Solander*. Tab. XXII, figs. 5 a—d.

VOLUTA COSTATA, *Soland.* 1766. Brand. Foss. Hant., p. 24; t. 3, fig. 45.

— — *Sow.* 1821. Min. Con., vol. iii, p. 163; t. 290, figs. 1 (non figs. 2 and 4).

Nec — — *Grat.* 1847. Conchyl. foss., &c. del'Adour; Supp. t. 1, fig. 14a—b.

nec — — *Sow.* 1850. Dixon's Geol. &c., of Suss., p. 107; t. 5, fig. 24.

V. testá ovato-fusiformi, costatá, lineis transversis ornatá; spirá elevatá, conicá; apice acuto: anfractibus convexiusculis; costis angustis inermibus; aperturá oblongo-ovalí, ad basin sub-profunde emarginatá; labro simplici, tenui; labio angusto; columellá sub-rectá, quadri-plicatá.

Shell ovately fusiform, longitudinally ribbed and ornamented with numerous transverse raised lines; spire conical, elevated, being as long or nearly as long as the aperture, and terminating in a small pointed pullus; whorls six or seven, exclusive of the pullus, and rather convex; the ribs simple, narrow, sharp, slightly curved and extending to the base, numerous on the early whorls, but becoming more distant as the shell is enlarged. The transverse lines, which are decussated by the lines of growth, are very slender, and irregular; every third or fourth line being thicker and more

elevated than the others, except towards the base, where the more prominent lines are placed nearer to each other, and the intermediate ones become very faint or altogether obsolete.—Aperture of an oblong-oval form, rather deeply notched in front; outer lip simple, sharp-edged and smooth within; inner lip very narrow, and thin; columella nearly straight, and furnished with two oblique folds in front, and two or three slender, obscure ones behind.

Brander's specimen in the British Museum, is unfortunately mislaid, and I have not been able to refer to it; but, judging from the description and figure given in his '*Fossilia Hantoniensis*,' the present Volute must be the true *V. costata* of Solander; for the word *inermis*, used by that naturalist in his description, cannot be applied to the shells, distinguished by the thick nodiform terminations of their ribs, which have been referred by Mr. Sowerby to that species.

D'Orbigny (Prod. de Paléont., vol. ii, p. 352, No. 267) has recorded this Volute as identical with the *Cochlea mixta* of Chemnitz, (*V. costaria*, Lamk.); but in that species the shell is longer and narrower, the surface quite smooth, except at the base; and the columella curved and furnished with two folds only. The two shells appear to me to be quite distinct from each other.

The shell from Bracklesham Bay figured in Mr. Dixon's work (t. 5, fig. 24) as *V. costata*, is a specimen of *V. Maja*; and those from Dax and Saubrigues, which Grateloup has considered to be identical with Solander's shell (fig. 45) appear to belong to a different species; they are represented as sub-turreted, with numerous rounded ribs, and with many folds on the columella, extending nearly to the posterior extremity of the aperture.

Size.—Axis, 2 inches nearly; diameter, 8-10ths of an inch nearly.

Locality.—Barton.

No. 110. VOLUTA HUMEROSA. F. E. Edwards. Tab. XXII, figs. 6 a, b.

VOLUTA COSTATA. Sow. 1821. Min. Con., vol. iii, p. 163; t. 290, figs. 2 and 4 (non fig. 1.)

Testá ovato-fusiformi, sub-turritá, costatá, transversim tenuissime lineatá, ad basin profunde et late emarginatá; spirá productá, apice acuto: anfractibus sub-planis; costis distantibus, crassis, rotundatis, postice nodigeris; aperturá ovato-rhomboidali, postice sub-canaliculatá; labro incrassato, intus lævi; labio angusto, crasso; columellá flexuosá, bis vel ter plicatá.

Shell ovately fusiform, sub-turreted, longitudinally ribbed, transversely finely striated; the base deeply and widely notched, and much bent backwards: spire elevated, but shorter than the last whorl; apex small, pointed: whorls five or six, exclusive of the embryonic whorls, very slightly convex, and flattened at the sides; ribs distant, broad, obtuse, reaching almost to the base, and at the posterior extremities

swelling into large, rounded tubercles. Aperture ovately rhomboidal, terminating behind in a narrow, but conspicuous, channel; outer lip smooth within, thickened towards the suture, otherwise thin and sharp-edged; inner lip narrow, thick, particularly at the posterior extremity, where it forms almost a callus; columella curved, and furnished with two prominent folds in front, and sometimes a third faint one behind.

The Volutes which I propose to separate under the present specific name, have been confounded hitherto with the preceding species (*V. costata*, Sol.); they appear, however, to be specifically distinct. The shells are broad, obtusely angulated at the shoulders, with flattened sides; the ribs are more distant, thicker, and rounder, and on the last two whorls rise at the shoulder into large tubercles; the transverse lineation is more regular, and the aperture wider, and not contracted behind; the inner lip is much thicker, the columella more curved, and furnished with two folds, or, occasionally only, with a third faint one behind; and the base is much more bent backwards, owing to the deeper anterior notch. Specimens occasionally occur in which, owing to the tubercles being less prominent than usual, the spire is more regular in form, and the shells present a general resemblance to *V. costata*; but the whorls still preserve the flatness of the sides, and the ribs their characteristic roundness; and the condition of the columella and the inner lip show, in fact, that the individuals in question are merely a variety of the present species.

Size.—Axis, 2 inches and 2-10ths; diameter, 1 inch and 1-10th nearly.

Localities.—Barton, and Bracklesham Bay.

Section A. (*Pullus small, conical.*

*b. Shell fusiform; costated, transversely
striated; inner lip narrow)* } *continued.*

β. Columellar plaits numerous.

No. 111. VOLUTA MAGA. *F. E. Edwards.* Tab. XXII, figs. 2 a—f.

VOLUTA MAGORUM. *Sow.* 1821. Min. Con., vol. iii, p. 164; t. 290, fig. 3.

— — *Morris.* 1843. Cat. Brit. Foss., p. 168.

— HARPULA. *Sow.* 1840. Min. Con., vol. vii, p. 7; t. 614, fig. 1.

— — *Morris.* 1843. Cat. Brit. Foss., p. 167.

— COSTATA. *Sow.* 1850. Dixon's Geol., &c., of Suss., p. 107, t. 5, fig. 24.

— MAGNORUM (ex errore). *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 353, No. 281.

— DECORA? *Beyr.* 1853. Die conchyl. des Norddeut. tertiarg. vol. i, p. 73; t. 4, figs. 5 a—b.

Nec. — MAGORUM. *Brocc.* 1814. Conchol. foss., Subapen., vol. ii, p. 307; t. 4, fig. 2.

nec. — HARPULA. *Lamk.* 1802. Ann. du Mus., vol. i, p. 478, No. 9, and vol. xvii, p. 78, No. 13.

V. testá ovato-fusiformi, unduloso-costatá, inermi, transversim tenuissime striatá, ad basin profunde emarginatá; spirá obtusá; apice sub-acuto; anfractibus sex vel septem,

depresso-convexis: aperturá oblongo-orali, antice effusá; labro ad marginem tenui, acuto, intús incrassato; labio angustissimo, crasso; columellá leviter arcuatá, pluries plicatá, plicá penultimá majori.

Shell ovately fusiform, ribbed, transversely furrowed, deeply notched, and bent backwards at the base; spire elevated, obtuse, with a small conical pullus; whorls six or seven, exclusive of the embryonic shell, convex, flattened at the sides, and separated by a deep suture. Ribs numerous, thick, rounded, slightly waved, and prolonged to the base; transverse furrows shallow, irregular, becoming faint, frequently almost obsolete, over the middle of the whorl. Aperture of an oblong-oval shape, wide in front, narrowing behind; outer lip simple, sharp-edged, and thickened within; inner lip very narrow, thick; columella slightly curved and furnished with ten or twelve folds, of which the front one is very oblique and moderately prominent, and the last but one larger and more transverse; the others rise almost to the suture, becoming feebler and more transverse as they ascend the columella. The ridge or crest on the columella, found in all the deeply notched species, is half concealed by the thick inner lip, but bulges out beyond the contour of the whorl.

The specimen of *V. magorum* figured by Brocchi was imperfect, and his description is short and unsatisfactory; it is, therefore, difficult to decide whether the shells described by Mr. Sowerby have been correctly referred by him to the Subapennine species. Judging, however, from Brocchi's figure and description, the *V. magorum* appears to be a more regularly convex shell, attenuated more equally at the extremities, and to have a more conical spire than the English shells. It is stated, also, to be smooth; but much reliance cannot be placed on this character, for Brocchi describes the shell as *convertita in ispato*, and the transverse furrows may have become obliterated in that process. The ribs are more numerous, and are slender and straight; the columellar folds also are more oblique, and the three front ones are nearly equal. The aperture appears to have been but slightly notched in front, inasmuch as the uninterrupted contour of the body whorl does not present the ridge caused by the retroflexion of the base, which always accompanies a deep notch. These distinctions, I think, show that the English shells, although closely allied to, are yet distinct from, Brocchi's species, or at all events that they cannot be safely considered as belonging to it.

The shells (figs. 2 *a, b*) referred by Mr. Sowerby to *V. harpula* (Lamk.), are only young shells of the present species, and are distinguished from the French species as well by the transverse striation as by the shorter and more obtuse spire, the more distant, thicker, and rounded ribs, the thinner outer lip, and the greater obliquity of the columellar folds.

Dr. Beyrich (*loc. cit.*) has described a Volute from Westeregeln (*Voluta decoru*) which resembles the present species so closely that it is difficult to separate the two. The chief differences appear to be that the transverse striation is perceptible on the

spire only, just below the suture, and on the front half of the body whorl; the whorls, although described as "almost flat," appear from the figure to be roundedly convex, and to be contracted towards the base, the columella is without the ridge, the presence of which evidences a deep notch, and the columellar folds appear to be nearly equal in size. In all other respects the two species agree. As to the transverse striation, that character becomes feeble on the last whorl of some of the English shells, and the absence of it in the only specimen of *V. decora*, possessed by Dr. Beyrich, and from which his description is taken, may be due to an imperfect preservation of the surface; the only difference, in fact, of specific value, is the character of the notch. Dr. Beyrich himself expresses great doubt whether the *V. magorum* of Sowerby is the same as his shell, and, without an actual comparison of the shells, I cannot venture to affirm their identity. If they should prove to belong to the same species, the name *V. decora* imposed by Dr. Beyrich will supersede the one I have given.

Individuals of the present species occur, although very rarely, at Bracklesham Bay, and usually retain traces of their ornamental colouring, consisting of numerous dark brown transverse bands, which I have not found in specimens from other localities.

Size.—Axis, 2 inches and 3-10ths; diameter, 1 inch.

Localities.—Barton, Highcliff, Alum Bay (Strat. No. 29, Prestw.), Bracklesham Bay.

German: Westeregeln in Magdeburgh (fide Beyrich)?

No. 112. *VOLUTA BRANDERI*. *Deshayes*. Tab. XXII, figs. 4 a, b.

VOLUTA BRANDERI. *Desh.* 1824—37. *Descr. des Coq. foss., &c.*, vol. ii, p. 701; t. 90, figs. 15—16.

— — *Defr.* 1829. *Dict. des Sci. nat.*, vol. lviii, p. 477.

V. testá ovato-oblongá, turritá, longitudinaliter costatá, cæterum lævi; spirá mediocri, acuminatá, apice acuto; anfractibus convexiusculis; costis crassis, rotundatis; aperturá elongatá, angustá, ad basin profunde emarginatá; labro incrassato, simplici; labio angusto; columellá triplicatá et rugis transversalibus instructá.

Shell oval-oblong, turreted, longitudinally ribbed, otherwise smooth; spire moderately elevated, and terminating in a small, conical pullus: whorls six or seven, slightly convex; ribs rather numerous, thick, round, extending in front almost to the base, and prolonged backwards to the very edge of the whorl, where they terminate abruptly, forming, with their truncated extremities, a flattened ledge, which gives a turreted aspect to the spire. The only specimen I possess consists of the spire, the front part of the shell being broken away; but in the French shells the whorls are traversed at the base by several undulating striae; the aperture is of a lengthened oval shape, deeply notched in front; the outer lip is much thickened, and smooth within; the inner lip is narrow, and the columella presents three moderately oblique folds in front,

of which the middle one is the largest and most prominent, and several transverse raised lines behind. Fig. 4 *b*, taken from a French specimen, is introduced for comparison, and to shew the perfect shell.

In general appearance, this Volute resembles *V. maga*; but it is quite smooth excepting where a few faint lines traverse the base; the spire is turreted, more slender, and tapering; and the ribs more numerous and more prominent.

Mr. Sowerby has described* a Volute from the tertiary formation in Cutch (*V. dentata*), which somewhat resembles the present species; but the ribs terminate posteriorly in erect, pointed tubercles, the surface of the shell is concentrically striated, the outer lip is plicated within, and the columella presents only two, nearly equal, prominent folds.

Size.—According to M. Deshayes, axis, 1 inch and a half; diameter, three-quarters of an inch.

Localities.—Bracklesham Bay. *French*: Monneville, Valmondois (fide Desh.); Les Clergis, Acy (fide D'Orb.).

No. 113. *VOLUTA PROTENSA*. *Sowerby*. Tab. XXIII, figs. 5 *a—c*.

VOLUTA PROTENSA. *Sow.* 1840. Min. Con., vol. vii, p. 5; t. 612, figs. 6, 7.

V. testá fusiformi, protensá, transversim striatá, in-juventá obscure costatá; spirá acuminatá, apice acuto: anfractibus convexiusculis, ad margines suturales depressis: aperturá angustá, profunde emarginatá; labro simplici, tenui, acuto; labio angusto; columellá pluries plicatá.

Shell fusiform, elongated, transversely striated, obscurely ribbed in the young state: spire elevated, being as long as the aperture, and terminating in a small, pointed apex: whorls six or seven, rather convex, depressed round the sutural margin, and having the edge pressed against the spire: aperture narrow, deeply notched at the base; outer lip simple, thin, and sharp-edged; inner lip very narrow; columella straight, furnished with six or seven distant oblique folds ascending to the top of the columella; the fold in front is the largest and most prominent, the others thread like, and nearly equal.

This appears to be a well-marked species, quite distinct from all the other Eocene Volutes.

Size.—Axis, 2 inches; diameter, 6-10ths of an inch.

Localities.—Chalk Farm, Whetstone, Potter's Bar.

* Grant's Geology of Cutch, Geol. Trans., 2d series, vol. v, p. 322; t. 25, fig. 26.

*Section B. Pullus sub-papillary.**a. Shell pyriform ; inner lip effuse ; columella plaits few.*No. 114. VOLUTA CITHARA. Lamarck. Tab. XXIII, figs. 6 *a—c*.*Henckel*. 1760. *Pyrotol.*, t. 5, fig. 9.*Favanne*. 1780. *D'Argenv. Conchyl.* (3d edit.), t. 166, fig. 4.*Burtin*. 1784. *Oryctogr. de Bruxelles*, t. 15, D.CITHARÆDUS. *Chemn.* 1795. *Conchy. cab.*, vol. xi, t. 212, figs. 2098, 2099.VOLUTA HARPA. *Lamk.* (non LINN). 1802. *Ann. du Mus.*, vol. i, p. 476, No. 1 ; and vol. xvii, p. 74, No. 1.— CITHARA. — 1816. *Tab. Encyclop. et méthod.*, t. 324, figs. 1 *a, b*.— — — 1822. *Hist. nat., &c.*, vol. vii, p. 346, No. 1.— — — *De France*. 1829. *Dict. des Sci. nat.*, vol. lviii, p. 474.— HARPA. *Desh.* 1833. *Encycl. méthod. (Vers)*, vol. iii, p. 1143, No. 21.— CITHARA. *Desh.* 1824—37. *Descr. des Coq. foss., &c.*, vol. ii, p. 681 ; t. 90, figs. 11, 12.— — — *Sow.* 1842. *Min. Con.*, vol. vii, p. 31 ; t. 625, figs. 1—3.— — — *Nyst.* 1843. *Desc. des Coq., &c., de la Belg.*, 590, No. 508.— — — *Sow.* 1850. *Dixon's Geol., &c., of Suss.*, p. 106 ; t. 5, fig. 17.— CYTHARA. *D'Orb.* 1850. *Prod. de Paléont.*, vol. ii, p. 353, No. 277.

V. testá ovato-oblongá, costatá, postice lævi, antice coarctatá, transversim sulcatá, late emarginatá ; spirá brevi, sub-muricatá, apice sub-papillari ; anfractibus convexis, ventricosus ; costis distantibus, postice bispinosus ; labro tenui, lævi ; labio antice expanso ; columellá quinquies plicatá.

Var. ANGULATA (fig. 6 *b*) *testá breviori, latiori, costis numerosioribus ; anfractibus angulatis, unicá serie spinarum coronatis.*

Shell ovate-oblong ventricose, contracted in front, ribbed, smooth except towards the base, where it is transversely furrowed ; spire short, armed with short spines ; apex conical, sub-papillary : whorls convex, rounded at the shoulder ; ribs distant, extending to the middle of the whorls, crowned with two or three rather blunt, nodiform spines, which are lost on the last whorl of the fully formed shell. The aperture is effuse, and widely notched in front ; the right lip is thin, sharp-edged, smooth within ; the columellar lip thin, widely spread over the front part of the body whorl ; columella furnished with one prominent very oblique fold in front, and three or four smaller ones behind.

The English specimens agree perfectly with the French shells, and the examination of a longer series of specimens than that to which Mr. Sowerby had access, shows that individuals occur here, as well as in France, having the spire considerably produced (fig. 6 *a*).

A short variety, (fig. 6 *b*), is also found, in which the whorls are angulated at the shoulder, the ribs are shorter, more numerous, and crowned with single, sharp, erect spines.

Size.—Axis 4 inches; diameter, $2\frac{1}{4}$ inches.

Localities.—Bracklesham Bay. *French*: Grignon, Courtagnon, Parnes (fide Desh.), Hattencourt, Hermes (fide D'Orb.). *Belgian*: Brussels, Panisel, near Mons (fide Nyst).

Section B. (Pullus sub-papillary) continued.

b. Shell fusiform; inner lip narrow; columellar plaits few.

No. 115. *VOLUTA UNIPLICATA*. Sowerby. Tab. XXIII, figs. 2 *a—c*.

VOLUTA UNIPLICATA. Sow. 1850. Dixon's Geol., &c., of Suss., pp. 107 and 188, t. 7, figs. 45, 46.

— *ANGUSTA*. Sow. 1850. Idem., t. 7, fig. 37.

V. testá fusiformi, obsolete costatá, in juventá transversim tenuissime striatá, ad basin obscure sulcatá, profunde emarginatá; spirá conicá, apice sub-papillari; anfractibus depresso-convexiusculis, obtuse angulatis; aperturá oblongo-ovali; labro incrassato, intus lævi; labio angusto, crasso; columellá leviter arcuatá, uniplicatá.

Shell fusiform, faintly ribbed, obscurely sulcated towards the base, and deeply notched in front; spire elongated and nearly conical; pullus sub-papillary: whorls rather convex, flattened at the side, and obscurely angulated at the shoulder; in the young state they are ornamented with crowded, very fine, transverse striæ. The ribs are prominent, thick, rounded, and produced nearly to the base; but on the last two or three whorls they become obsolete, and are replaced by a row of obscure, blunt tubercles placed on the angle of the shoulder; the transverse striation is also lost, and the body whorl is smooth, except where the shallow, faint, basal furrows appear; the aperture is of a lengthened oval shape; the outer lip thickened near the suture, rather sharp-edged towards the front, and smooth within; the inner lip narrow and thick; the columella slightly curved, and furnished with one prominent fold, placed nearer to the anterior extremity than is usually the case.

Fig. 2 *a* is taken from the shell figured in Mr. Dixon's work (t. 7, fig. 37) as *V. angusta*.

This species, which appears to be well characterised, is not uncommon.

Size.—Axis, 3 inches nearly; diameter, 9-10ths of an inch.

Locality.—Bracklesham Bay.

No. 116. *VOLUTA MURICINA*. *Lamarck*. Tab. XXIII, figs. 1 *a—c*.

		<i>Lister</i> . 1685. Hist. Conchyl., t. 1033, fig. 6?
		<i>Favanne</i> . 1780. D'Argenv. Conchyl. (3d edit.), t. 66, fig. 1.
COCHLEA MIXTA?		<i>Chemn.</i> 1795. Conchyl. cab., vol. xi, t. 212, figs. 3010—3011.
VOLUTA MURICINA.	<i>Lamk.</i>	1816. Tableau Encyclop. et méth., t. 383, fig. 1 <i>a—b</i> .
—	—	— 1802. Ann. du Mus., vol. i, p. 477, No. 4; vol. xvii, p. 75, No. 5.
—	—	— 1822. Hist. nat., &c., vol. vii, p. 350, No. 5.
—	—	<i>Deifr.</i> 1829. Dict. des Sci. nat., vol. lviii, p. 475.
—	—	<i>Desh.</i> 1833. Encyl. méth. (Vers), vol. iii, p. 1144, No. 24.
—	—	— 1824—37. Descr. des Coq. foss., &c., vol. ii, p. 697; t. 91, figs. 18—19; t. 93, figs. 3—4; t. 94, figs. 3—4.
—	—	<i>Sow.</i> 1844. Min. Con., vol. vii, p. 31; t. 626, figs. 4—6.
—	—	— 1850. Dixon's Geol., &c., of Suss., p. 107; t. 5, fig. 20.

V. testá ovato-fusiformi, ad basin sub-productá, late emarginatá, antice lævi, postice longitudinaliter tuberculato-costatá; spirá elongatá, apice obtuso: anfractibus angulatis, in juventú tenuissime transversim striatis, ultimo anfractu spiram in longitudine rix superanti: aperturá oblongo-ovatá; labro simplici; labio angusto; columellá ter vel quater plicatá, inter plicas anteriores sulco lato exaratá.

Shell ovately fusiform, produced, and widely, but not deeply, notched at the base; spire long and pointed, with a sub-papillary apex; whorls six or seven, obscurely furrowed at the base, smooth elsewhere, wide and angulated at the shoulder, crowned with a single row of pointed, pyramidal tubercles, having their bases prolonged into obtuse ribs, which are lost about the middle of the whorl; the last whorl is conical, and rather longer than the spire. In the immature shell the whorls are ornamented with numerous, very slender, transverse striæ, which are lost as the shell approaches maturity. The aperture is of an oblong oval shape; outer lip rather thick, with a blunt margin; inner lip narrow, thickened; columella round, curved, furnished with one large, prominent fold in front, and two or three smaller folds behind, and deeply furrowed between the two front folds.

The ribs sometimes, particularly in young specimens, extend far down the whorl, almost to the base, and the tubercles are rounded: specimens also occur which are narrower, and more slender than the typical form; and, again, others are found wider and shorter, according to the condition of the ribs. Indeed, as both M. Deshayes and Mr. Sowerby have remarked, the shell is so variable in this respect, as to render it difficult to define. The transverse striation is found as well on the French as on the English shells, although that character is not noticed either by Lamarck or Deshayes.

Size.—Axis, 3 inches and 4-10ths; diameter, 1 inch and 6-10ths.

Localities.—Bracklesham Bay. *French*: Grignon, Parnes, Mouchy, Courtagnon (fide Desh.), Chaumont (fide D'Orb.).

*Section C. Pullus papillary.**a. Shell fusiform; inner lip effuse; columella plaits few.*No. 117. *VOLUTA WETHERELLII. Sowerby. Tab. XXIII, figs. 4 a—d.**VOLUTA WETHERELLII. Sow. 1836. Lond. and Edinb. Phil. Mag., and Journ. of Science, 3d ser., vol. ix, p. 463, note.*— — *Sow. 1840. Min. Con., vol. vii, p. 5; t. 612, figs. 1—5.*

V. testá fusiformi, elongatá, ad basin parum emarginatá? in juventú concentrice lineatá, deinde lævi; lineis confertis, subtilissimis; spirá conicá, apice papillari: anfractibus sex vel septem, convexis, marginibus ad spiram adpressis: aperturá elongato-ovali; columellá subrectá, triplicatá; labro ?; labio effuso.

Shell fusiform, elongated, slightly produced in front; spire conical, elevated, and terminating in an obtuse papillary apex: whorls six or seven, convex, with the margins pressed against the preceding volutions, and presenting a broad, shallow depression, which runs round the spire between the shoulder and the suture. The earlier whorls are ornamented with numerous concentric raised lines; these lines are much crowded, and so very fine as to be scarcely visible by the naked eye, and do not detract from the apparently even surface; the last whorl is smooth. Aperture of a lengthened oval form, columella nearly straight, and furnished at maturity with moderately oblique folds, of which the one in front is the smallest, and that in the middle the largest; inner lip widely spread over the body-whorl, but not extending backwards beyond the suture; the base, apparently, but slightly notched, as the columella does not present any prominent ridge. The outer lip is not preserved in any specimen I have seen.

This Volute presents a remarkably close analogy with the well-known Crag species *V. Lamberti*; but it is a longer, narrower shell, with a much smaller pullus; and the columella presents three unequal folds instead of the four nearly equal folds which characterise that species. It appears to be confined to the lower formations in the neighbourhood of London, and has not as yet been found, I believe, at Highgate.

Size.—The actual dimensions cannot be stated accurately; those of the largest of the specimens figured must have been, axis, 5 inches, nearly; diameter, 1 inch and 8-10ths, nearly.

Localities.—Camden Town, Chalk Farm, Haverstock Hill, Hornsey, Copenhagen Fields, Holloway, Whetstone, Potter's Bar, Bayswater, Brentford, Sheppey.

Genus 24th. MITRA.* *Lamarck*. 1801.MITRA, TURRIS, *Montf.*, 1810.CYLINDRA, IMBRICARIA, *Schum.*, 1817.TIARA, MITREOLA, CONELIX, MITRELLA, *Swains.*, 1840.VULPECULA, *Gray*, 1840.

Gen. Char.—Shell fusiform, smooth, longitudinally ribbed or cancellated; spire elevated, pointed: aperture longitudinal, narrow, notched at the base, and without a canal, or at most with a very short one; outer lip sometimes thickened, generally sharp-edged, internally smooth or crenulate; columella plaited, folds regular, nearly transverse, the anterior one the smallest.

The Mitres are distinguished from the Volutes, with which they had been associated until they were separated by Lamarck, by their more elongated, less ventricose form, and by the character of the columellar plaits, which are more transverse and regular, with the smaller one in front, a disposition the reverse of that which characterises the Volutes.

The animal has a small, narrow head, with short, pointed tentacles, on the external sides or bases of which the eyes are placed; but some species from the Mediterranean, according to M. Deshayes, bear pedicels much shorter than the tentacles, united to them, and terminated by the ocular points. The foot is narrow, truncate in front, pointed behind; and the anterior margin of the mantle is produced into a short, cylindrical canal. But that which chiefly distinguishes the animal of *Mitra*, is the great length of the proboscis, which, in some species, considerably exceeds that of the shell.

The Mitres, as defined by Lamarck, have been subdivided into several genera, dependent chiefly on conchological distinctions. In some of these divisions the animals, according to observations recently made by Dr. Gray, exhibit modifications of the lingual teeth closely resembling those characteristic of other genera; and that eminent naturalist, therefore, regards the *Mitræ* as forming a family distinct from the *Volutidæ*, with which they have usually been associated. The small, narrow foot, and elongated proboscis lead, apparently, to the same conclusion.

The living *Mitræ* are very numerous; upwards of 350 species being known; of these one is from the coast of Greenland, and some few small species are found in the Mediterranean. With these exceptions, the *Mitræ* are confined to tropical or sub-tropical seas, where they are found, according to Messrs. Adams, chiefly on the shores of islands, but few species inhabiting continental shores. They appear to be deep-sea molluscs, most of the species ranging in depth from 15 to 80 fathoms, although some few are littoral.

* Etym. *Mitra*, a turban or covering for the head, worn by the Persians and other Asiatics.

In a fossil state, the genus first appears in the cretaceous formations, in which five or six species are stated to occur; but during the tertiary epoch, the species became much more numerous. More than forty have been described from the eocene strata, and a still greater number from the more recent deposits. From the English eocene strata, four species have been noticed; of these, three, described by Mr. Sowerby in 'Mineral Conchology,' appear to be confined to this country; the fourth occurs at Bracklesham, and is identical with a species abundant in the Paris basin. Three additional species are now described for the first time.

No. 118. MITRA SCABRA. Sowerby. Tab. XXIV, fig. 6 a—c.

SMALL LATTICED LYMINGTON WHELK, *Pet.* 1764. *Gazophyll.*, t. 73, fig. 9.

BUCCINUM SCABRICULUM, *Soland.* (non *Gmel.*) 1766. *Brand. Foss. Hant.*, p. 15, fig. 20.

MITRA SCABRA, *Sow.* 1823. *Min. Con.*, vol. iv, p. 142, t. 401.

— — *Morris.* 1843. *Cat. Brit. Foss.*, p. 151.

— — *D'Orb.* 1850. *Prod. de Paléont.*, vol. ii, p. 355, No. 313.

— — *Morris.* 1854. *Cat. Brit. Foss.* (2d edit.), p. 258.

M. testá ovato-acutá, costulis longitudinalibus et lineis transversis sese decussantibus scabratá, ad basin profunde emarginatá: spirá conicá, apice obtusiusculo: anfractibus convexis, marginibus posticis tenuibus: aperturá elongato-ovali, postice angustatá; labro incrassato, sub-marginato, intus crenulato; columellá quadri-plicatá, plicis distantibus, fere transversis; labií areá pliciferá incrassatá.

Shell ovately oblong, slightly ventricose, deeply notched at the base, with a conical spire, terminating in a small, slightly obtuse apex, formed of two smooth, nearly round, embryonal volutions; whorls seven or eight, exclusive of the embryo, and covered with irregular longitudinal ridges, and conspicuous lines of growth, decussated by sharp, transverse, raised lines slightly thickened at the points of decussation, roughening the surface of the shell; the posterior margins are thin, and pressed against the preceding whorls. The aperture is of a lengthened oval shape, narrowed posteriorly: the outer lip sharp and thin in the young shell, but irregularly thickened at maturity, and presenting an obscure, slender, raised border along the outer edge, and a blunt triangular tooth-like callus on the inner edge, near the posterior extremity; the columella is furnished with four distant, nearly transverse folds, of which the anterior one is much the smallest; and some specimens also present one or two obscure transverse lines towards the posterior part of the columella. The inner lip is very narrow, and much thickened where the folds are placed. Owing to the great depth of the notch, the base of the shell is more bent backwards than is usually the case in the fossil *Mitra*, and presents the prominent crest or ridge which, as we have seen in the *Volutes*, always accompanies a deep notch.

In the general form of the shell, the condition of the apex and of the outer lip, the columellar plaits, and the deep anterior notch, this *Mitra* so much resembles *M. labratula*, that it might almost be regarded as merely a variety of that species in which the longitudinal ribs and transverse lines found in the young state have been continued on the mature shell. I have not, however, met with any smooth specimen of the present species, and mature individuals of *M. labratula* are, apparently, always smooth, with the exception of a few obscure transverse lines near the suture, or at the base. This want of intermediate forms, therefore, confirms the title of *M. scabra* to specific distinction.

Size.—Axis, 11-12ths of an inch; diameter, 5-12ths of an inch.

Locality.—The species appears to be confined to the Barton beds. I have not met with it elsewhere.

No. 119. MITRA LABRATULA. *Lamarch*. Tab. XXIV, fig. 3 *a*, *b*.

- MITRA LABRATULA, *Lamk.* 1803. Ann. du Mus., vol. ii, p. 58, No. 5, t. 3, fig. 6.
 — LABRATULLA, *Id.* 1816. Tab. Encycl. et Méthod., t. 392, fig. 3 *a*, *b*.
 — LABRATULA, *Id.* 1822. Hist. Nat., vol. vii, p. 325, No. 5.
 — — *Defr.* 1824. Dict. des Sci. Nat., vol. xxxi, p. 491.
 — — *Desh.* 1830. Encyc. Méthod. (vers.), vol. ii, p. 465, No. 42.
 — — *Id.* 1824—37. Descr. des Coq. Foss. &c., vol. ii, p. 672, t. 88, figs. 9, 10, 18 and 19.
 — — *Meller.* 1843. Mém. sur les Sables tert. inf., &c., de Paris, p. 17.
 — — *Roissy.* . Buff. Moll., vol. v, p. 443.
 — MONODONTA, *Sow.* (non *Lamk.*) 1850. Dix. Geol., &c., Suss., p. 106, t. 7, figs. 20, 21.
 — LABRATULA, *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 354, No. 296.

M. testá ovato-acutá, lavi, aliquando in juvená costulis et striis transversis decussatá, ad basin profunde emarginatá: spirá conicá, apice obtuso: aperturá elongatá, angustá; labro incrassato, sub-marginato, intús unidentato; columellá quadriplicatá.

Shell ovately oblong, slightly ventricose, smooth; sometimes in French specimens the early volutions present obscure undulating ribs, decussated by irregular, transverse, fine, raised lines, which altogether disappear on the last volution, or are reduced to a few faint lines, nearly obsolete, at the base, or round the sutural margin: the spire is conical with an apex formed, like that of *M. scabra*, of two roundish embryonal whorls, and, as in that species, the base is deeply notched, and bent backwards. The aperture is of a long, ovate shape, and rather narrow; the outer lip thickened, slightly bent outwards, so as to form a narrow, raised border along the outer margin, and furnished, generally, with a blunt, tooth-like callus on the inner edge, near the posterior extremity; the columella presents four prominent, almost transverse folds, the posterior three of which are nearly equal, and are larger than the one in front. •

All the English specimens I have seen belong to the smooth variety, and do not present the longitudinal ribs and transverse lines which are sometimes found on the earlier whorls of the French shells, nor have I met with any specimen presenting the concentric striæ on the surface which characterise the variety from Courtagnon and the neighbourhood of Valognes.

I have already mentioned the strong resemblance between this species and *M. scabra*; in fact, with the exception of the scabrous aspect of the latter, it would be difficult to point out specific differences between the two.

M. Deshayes states that in some of the French specimens traces of the natural colouring remain, consisting of longitudinal iron-reddish coloured bands. The English specimens, imbedded in a less favorable matrix, do not present any traces of their original colouring.

Size.—Axis, 11-12ths of an inch; diameter, rather more than 5-12ths of an inch.

Localities.—Bracklesham Bay, where it is somewhat rare. *French*: Grignon, Parnes, Mouchy, Courtagnon, Chaumont, Valognes, St. Felix, Le Tomberay (fide *Desk.*), and Laon (fide *Mellev.*).

No. 120. MITRA PARVA. *Sowerby*. Tab. XXIV, fig. 1 *a—c*, and 2 *a—c*.

MITRA PARVA, *Sow.* 1825. Min. Con., vol. v, p. 37, t. 430, fig. 1.

— PUMILA, *Ib.* 1825. Min. Con., vol. v, p. 37, t. 430, fig. 2.

— PARVA, *Ib.* 1850. Dixon's Geol., &c., of Sussex, p. 106.

— — *Morris.* 1843. Cat. of Brit. Foss., p. 151.

— PUMILA, *Ib.* 1843. Cat. of Brit. Foss., p. 151.

— PARVA. *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 355, No. 314.

— PUMILA. *Ib.* 1850. Prod. de Paléont., vol. ii, p. 355, No. 315.

— PARVA. *Morris.* 1854. Cat. of Brit. Foss., 2d edit., p. 258.

— PUMILA. *Ib.* 1854. Cat. of Brit. Foss., 2d edit., p. 258.

M. testá parvá, ovato-fusiformi, sub-turritá, concentricè sulcatá, ad basin rix emarginatá: spirá elevatá, acuminatá: anfractibus convexis, uno sulco prope marginem suturalem circumdati; suturis distinctis: aperturá lanceolatá: labro undato, acuto, intús plicifero. columellá quinquies plicatá.

Var. SEMILÆVIS. Testá anfractibus uno sulco prope marginem suturalem circumdati; et ad basin obscure sulcati, cæterum lævi; spirá cæsertiori.

Var. PUMILA, fig. 2 a—c. Testá fasciolis elevatis concentricis et costellis longitudinalibus decussatá.

Var. β. Testá costellarum longitudinalium experti.

Shell small, ovately fusiform, transversely furrowed, and but slightly notched at the base; spire elevated, pointed, and formed of seven or eight convex volutions.

separated by a deep suture, and with the margins thickened and rather depressed, giving a sub-turreted character to the spire; the furrows are broad, round, and nearly regular; the posterior furrow is deeper than the others, and from this circumstance the margin of the whorls assumes the appearance of a rim. The aperture is narrow, and of a lengthened oval form; the outer lip waved, sharp-edged, and plicated within, at a short distance from the margin; the columella is nearly straight, and presents near the middle two rather prominent and nearly transverse folds, and in front of them three others more oblique, and of which the anterior one is much the smallest.

In the variety *semilarvis*, the whorls are nearly smooth, presenting only the deep sulcus round the sutural margin, and a few obscure furrows, almost obliterated, near the base; and the spire is rather more elevated than in the type.

In the variety *pumila*, the surface of the whorls presents numerous longitudinal, irregular, slightly waved costellæ, not much elevated, but extending almost to the base, and crossed by concentric raised bands, which decussate them, and impart a rough aspect to the shell. The concentric bands are irregular, more or less numerous in different individuals, and rather flattened on the upper surface. When the costellæ are well defined, the concentric bands, at the points of decussation, rise into little tubercles; the marginal band, thus tuberculated, forms the crenulated edge to the whorls noticed by Mr. Sowerby; but this does not appear to be a constant character.

Occasionally specimens occur (*var. β*) in which the longitudinal costellæ are altogether wanting, and the whorls present only the concentric bands.

If we look only at the extreme forms figured in 'Mineral Conchology,' it need not excite surprise that Mr. Sowerby, who had not any intermediate forms before him, should have described the variety *pumila* as a distinct species. On an attentive examination, however, it will be seen that the distinction between that variety and the type lies in the character of the transverse marking, which in the type consists of shallow, rounded furrows; while in the variety it assumes the form of flattened bands. This difference, however, which is attributable to the greater or less depth of the furrows, cannot be regarded as of specific value; and the occurrence of ribless specimens with transverse bands, shows that the presence or absence of the costellæ is not a character on which reliance is to be placed.

The apex of the shell appears to have been very susceptible of erosion, for specimens with the embryonal whorls preserved are very rare.

Size.—Axis, rather more than 3-12ths of an inch; diameter, 2-12ths of an inch, nearly.

Localities.—For the type, Higheliff, where it is found in profusion, Barton, Alum Bay (No. 29, Prestw.), where the variety *semilarvis* is abundant, and Brockenhurst; and for the variety *pumila*, Highgate, Basingstoke, Bracklesham Bay, Bramsbaw (New Forest), and Barton. The species appears to be confined to England.

No. 121. MITRA PORRECTA. *F. E. Edwards.* Tab. XXIV, fig. 7 *a—c.*MITRA PORRECTA, *Morris.* 1854. Cat. Brit. Foss., 2d edit., p. 258.

M. testá elongato-fusiformi, gracili, ad basin concentricè sulcatá, cæterum lævi; spirá porrectá: anfractibus depresso-convexis, unico sulco prope marginem suturalem circumdati; marginibus posticis simplicibus: aperturá angustá, lineari; labro acuto, intús crenulato; columellá quinquies plicatá.

Shell elongated, fusiform, slender; smooth, except at the base, where it is traversed by several broadish, obscure furrows; the spire elevated, nearly equalling the aperture in length; the volutions, seven or eight, flatly convex, with the posterior margins simple, and bordered by a deep furrow, which runs round the shell near the suture. The aperture is narrow, with nearly parallel margins; the outer lip sharp-edged, and finely and regularly crenulated within; the columella presents five sharp folds, of which the anterior two are very oblique, and much smaller than the others.

In the smooth surface, margined whorls, sharp outer lip, and columellar folds, this *Mitra* resembles *M. marginata* (Lamk.), from the Paris basin. It is, however, a much narrower and more slender shell; the margins of the whorls are without the crenulations which characterise that species, and the outer lip is finely crenulated within. The species appears to be perfectly distinct.

Size.—Axis, 4-12ths of an inch; diameter, 1-8th of an inch.

Localities.—Barton, Bracklesham Bay.

No. 122. MITRA OBESA. *F. E. Edwards.* Tab. XXIV, fig. 4 *a—d.*

M. testá ovato-oblongá, ad basin concentricè sulcatá, cæterum lævi; spirá acuminatá, aperturam in longitudine vix æquantí; anfractibus convexiusculis, antice coarctatis, postice marginatis; aperturá elongato-ovali; columellá terties plicatá.

An ovately oblong shell, smooth except at the base, where it is traversed by a few obscure furrows; spire elevated, nearly as long as the aperture, and terminating in a small, pointed pullus, formed of two round, smooth, unequal volutions; the whorls, which are five in number, exclusive of the embryo, are flatly convex, and contract rather suddenly in front; the posterior margin is bordered by a shallow furrow, which runs round the suture, and the edge is depressed and flattened, giving somewhat of a turreted appearance to the spire. The aperture is ovate, moderately wide, and terminates in front in a short, wide canal, formed by the sudden contraction of the whorl: the columella is nearly straight, and presents three oblique distant folds.

The general form, the width and greater size of the shell, and the number of the

columellar plaits, distinguish this species from the smooth variety of *M. parva*, and from *M. gracilis*. It is extremely rare: the specimen figured is, I believe, unique.

Size.—Axis, 5-12ths of an inch; diameter, rather more than 2-12ths of an inch.

Locality.—Highcliff.

No. 123. MITRA VOLUTIFORMIS. *F. E. Edwards*. Tab. XXIV, fig. 5 *a—c*.

MITRA VOLUTIFORMIS. *Morr*. 1854. Cat. Brit. Foss., 2d edit., p. 258.

M. testá parvâ, oblongâ, turrîtâ, longitudinaliter costatâ, antice transversim lineatâ, postice concentrice sulcatâ, cæterum lævi; spirâ exsertâ, in longitudine dimidium totius testæ superanti: anfractibus planis, antice subito coarctatis, ad suturas marginatis et unicâ serie tuberculorum instructis; costis crebris, elevatis, rectis, fere ad basin tendentibus, postice nodulosis: aperturâ angustâ; labro intus plicato; columellâ quadriplicatâ; labio angustissimo, postice incrassato.

Shell small, oblong, turreted, longitudinally ribbed; spire elevated, exceeding the aperture in length; whorls five or six, exclusive of the embryonal whorls, with the sides nearly straight, and contracting suddenly towards the base, where they present five or six transverse, coarse, raised lines; the sutural margin is bordered by a single row of round tubercles, corresponding with the ribs; the posterior surface is concentrically furrowed; the middle surface smooth; the ribs, which are numerous, prominent, and straight, extend to the transverse raised lines on the base, and terminate, posteriorly, in a double row of knobs or tubercles, somewhat larger than those which run round the suture, and from which they are separated by a deep furrow. The aperture is lanceolate, and, owing to the contraction of the whorls, terminates anteriorly in a short, narrow canal, which is slightly emarginate in front; the outer lip is plicated within; the inner lip very narrow, and thickened near the suture, where it forms an oblong callus; the columella is slightly curved, and furnished with four oblique folds, gradually increasing in size as they ascend the columella.

The specimen figured is, I believe, unique. It is apparently an immature shell; but the characters are so strongly marked, and so distinct from those of the other English Eocene Mitræ, that it cannot be passed unnoticed.

Size.—Axis, 3-12ths of an inch; diameter, somewhat less than 2-12ths of an inch.

Locality.—Barton.

Family—CONIDÆ.Genus 25th. CONUS. *Linn.*CONUS *Brug.; Lamarck; Cuvier; De Blainv.*VOLUTA, *Browne* (not *Linn.*), 1756.STROMBUS, *Adan.* (not *Linn.*), 1757.CUCULLUS, *Bolten*, 1798.CONARIUS, *Dumér.*, 1806.RHOMBUS, *Montfort*, 1810.CONULUS, *Rafin.* (not *Fitzing.*), 1814.PUNCTICULIS—CORONAXIS—CONILITHES, *Swains.*, 1840.STEPHANOCONUS, *Mörch*, 1852.CYLINDRELLA, *Swains.* (not *Pfeiffer*), 1840.DENDROCONUS, *Ib.* 1840.LITHOCONUS, *Mörch*, 1852.CYLINDER, *Montfort*, 1810.TEXTILIA, *Swains.*, 1840.HERMES, *Montfort*, 1810.THELICONUS, *Swains.*, 1840.LEPTOCONUS, *Ib.* 1840.RHIZOCONUS—CHELYCONUS, *Mörch*, 1852.Sect. α NUBECULA, *Klein*, 1753.ROLLUS, *Montfort*, 1810.UTRICULUS, *Schum.*, 1817.TULIPARIA, *Swains.*, 1840.Sect. β CONORBIS, *Ib.* 1840.

Gen. Char.—Shell inversely conical, turbinate, rarely ventricose, smooth or concentrically furrowed or striated; spire truncate, short, or more or less elevated; whorls numerous, coronated or simple; aperture linear, narrow, slightly effuse, and emarginate in front; outer lip thin, and sharp at the edge, smooth, sometimes thickened within, generally straight, occasionally curved, notched at the suture; columella straight, smooth, truncate in front; covered with an epidermis, and operculated; operculum small, corneous.

In the genera which constitute the families *Cypræidæ* and *Volutidæ*, the animals are distinguished by their large mantles, capable, as we have seen, of great extension. In the present genus, the type of the family to which its name is given, the animal is furnished with a narrow mantle, prolonged in front into a short, fleshy siphon, resembling that of the *Volutes* and *Mitres*, by which water is conveyed to the branchial chamber. The head is small, and carries two subulate tentacles, near the free extremities of which the eyes are placed: it terminates in a retractile, proboscis-like muzzle.

at the end of which is the mouth, surrounded by a funnel-shaped veil: the teeth are elongate, subulate, and arranged in two series. The foot is simple, oblong, narrow, and truncated in front; in the middle it presents a pore, the function of which is not ascertained; and it bears, on the posterior extremity, a small, ovate, horny operculum, barely exceeding in length a third part of the aperture, and very narrow, so as to permit the animal to withdraw far within the shell. The epidermis, which covers the shell, is thick, and frequently very tenacious.

The cone-animal is endowed with the power of dissolving the calcareous matter on the outer surface of the inner whorls, which are thus made exceedingly thin, whatever degree of thickness they may have originally possessed. This power of absorption is possessed by many other molluscs, but, according to Mr. George Sowerby, is confined to those furnished with an operculum. It affords a valuable assistance to the Palæontologist.

The present genus, although comprising very many species, remains almost as Linnæus left it. The foregoing list of synonyms shows, indeed, that many dismemberments have been proposed; but at present these appear to depend principally on differences in the shells. In Klein's proposed genus *Nubecula*, however, the shell of which is sub-cylindrical, the animal, according to M. Quoy,* is furnished with a large foot, not entirely retractile within the shell; the margin of the muzzle is fringed, and the operculum is curved and unguiculate: these peculiarities apparently justify the division in question being retained as a sub-genus.

The wide semicircular notch which, in many of the cones, separates the outer lip from the suture, closely resembles the sinus characteristic of the *Pleurotomæ*, and in some of the fossil species in which the outer lip is generally very much curved, it is difficult to determine to which genus the particular shell should be referred. In the well-known Eocene species, *Conus dormitor* (Sol.), for instance, the shell outwardly possesses quite as much of the character of a *Pleurotoma* as of that of a *Cone*; and Mr. Swainson has, in fact, taken it as the type for a genus which he has named *Conorbis*, and which, in his circle of affinities of the *Coninæ*, he regards as the representative of the *Pleurotomæ*. This division depends entirely on the external characters of the shell: no living representative, I believe, has as yet been found, and the animal is therefore unknown. It is certain, however, that it was a true cone-animal; for, on breaking the shell of a specimen of *Conus dormitor*, the inner whorls will be found reduced by absorption to a membrane-like thinness; and the capability to effect this is not, I believe, possessed by the animal of *Pleurotoma*. The proposed genus is not well defined by its author, and is not generally received, although it may be usefully adopted as a section of the present genus. The characters appear to be the elevated conical spire, the produced base representing the canal which dis-

* Zoologie of the Voyage of the *Astrolabe*.

tinguishes the *Pleurotomæ*; the condition of the outer lip, which is much thickened within, and so strongly arched as to be almost semicircular in form; the deep, wide sinus, which divides the posterior extremity of the outer lip from the suture, and exactly resembles the notch by which the *Pseudotomæ* (a section of the *Pleurotomæ* proposed by Bellardi) are distinguished; and the elevated, reflected anterior margin of the columellar lip, forming the right wall of the anterior canal.

The recent cones, distinguished by the beauty and variety of their colouring, are very numerous: three hundred and sixty-nine species are enumerated by Messrs. Henry and Arthur Adams in the different divisions adopted by those authors; and, excepting two species which are found in the Mediterranean, all are inhabitants of tropical seas, abounding chiefly in those of Asia. They inhabit fissures and holes in rocks, and coral reefs, ranging in depth from low-water mark to thirty or forty fathoms.

In a fossil state, the genus first occurs in the upper cretaceous strata. M. Deslongchamps, it is true, has referred to it certain shells from the lias of Calvados, exactly resembling cones in outward form, and which, if the genus were correctly determined, would present the anomaly of the cones not being represented during the long epoch which elapsed between the deposit of the middle lias and that of the upper chalk. M. D'Orbigny, however, found, on examination, that the inner whorls were as thick as the outer ones; and from this circumstance he has inferred that the shells in question are not true cones, and he has referred them to *Acteonina*, a genus peculiar to the Oolitic formations, and proposed by him for certain Acteon-like shells, without teeth or folds on the columella. And thus the apparent anomaly disappears. In Europe two species only have hitherto been found in the Chalk—one from Tours, described by Dujardin; the other from Martigues (Bas du Rhone), described by Mathéron: and from the eocene strata, sixteen species have been described by Solander, Bruguière, Lamarck, Sowerby, and Deshayes. After the eocene era, the genus disappears from our Fauna; although, on the Continent, it appears to have been largely developed during the miocene and pleiocene epochs, sixty-seven species having been described by Grateloup, Michelotti, Brocchi, Borson, and other authors, from the formations of those periods, in France, Italy, and Germany. In America only four species, I believe, have as yet been found—one in the Chalk of South Carolina, a second in the eocene strata of Alabama, and two in the more recent formations.

No. 124. *CONUS DIADEMA*, *F. E. Edwards*. Tab. XXIV, fig. 8 *a—d*.

CONUS DIVERSIFORMIS, *Sow.* (non *Desh.*) 1841. *Min. Con.*, vol. vii, p. 26, t. 623, figs. 3, 4, 6.

— — *Morris.* 1843. *Cat. Brit. Foss.*, p. 143.

— — *Sow.* 1850. *Dixon's Geol., &c., of Suss.*, p. 108, t. 8, fig. 10.

— — *Morris.* 1854. *Cat. Brit. Foss.*, 2d edit., p. 244.

C. testá conicá, oblongá, sub-turritá, coronatá, lævi, ad basin transversim obscure sulcatá; spirá elevatá, sed trientem totius testæ longitudine nequaquam æquanti; anfractibus numerosis, angulatis, marginibus posticis depressis, sub-cavatis, concentricè lineatis: aperturá angustá; labro mediocriter arcuato, postice late emarginato.

Var. PYRIFORMIS (fig. 8 *d*). *Testá spirá depressá.*

CONUS PYRIFORMIS, *Sow.* 1850. *Dixon's Geol., &c., of Suss.*, pp. 108 and 189, t. 8, fig. 18.

— — *Morris.* 1854. *Cat. Brit. Foss.*, 2d edit., p. 244.

A smooth, oblong, conical shell, with a turreted spire, formed of numerous (10—12) volutions, and moderately elevated, varying to some extent in different individuals, but never attaining a height equal to a third part of the length of the shell. The whorls are nearly straight on the sides, with the posterior margins much depressed, somewhat concave, and ornamented with four or five thickish, concentric, raised lines, separated by shallow, rounded furrows; the angles of the whorls present a series of oblong, regular tubercles, which are continued almost to the last whorl, when they are replaced by a rounded, cord-like thickening of the shoulder; the front part of the whorls is traversed by shallow, irregular furrows, which are effaced towards the middle part of the shell. The aperture is narrow, with parallel margins; the outer lip moderately arched, and presenting a wide, shallow curvature between the angle and the suture.

The specimens separated by Mr. Sowerby, under the specific name *pyriformis*, have a much depressed spire associated with the tuberculation, and other characters which distinguish the present species, of which, therefore, I regard them as a variety only.

The shells for which I propose the specific name, *C. diadema*, were referred by Mr. Sowerby, in part to *C. deperditus* (Brug.), and in part to *C. diversiformis* (Desh.). In the former species, however, the shell is narrower and more turbate, with a more curved outer lip, and the tuberculation on the spire, where it occurs, is feeble and lost on the very early whorls; and in the latter species, M. Deshayes, in his description, states expressly that the angles of the whorls are somewhat sharp, and always simple;*

* It is somewhat difficult to appreciate the distinct specific value of the shells constituting the species *C. diversiformis*, without an examination of a series of specimens equal to that upon the study of which M. Deshayes proposed the separation. To the unschooled eye they appear to be only broader forms of *C. deperditus*, with more variable spires.

while in the English shells, the angles of the whorls are blunt and strongly tuberculated, resembling in that character *C. sulciferus* (Desh.), to which, indeed, I should be inclined to refer them, notwithstanding the transverse sulcation from which the name is taken, but on which much stress is not to be placed, as it does not appear to be a strongly marked character; the shell of *C. sulciferus*, however, is thick and ponderous, with a narrower aperture, and a deeper curvature in the outer lip. In *C. Lamarckii* (a name which I propose to give to the cocene species still miscalled *C. antediluvianus*), the tubercles are also found, but they are not so prominent nor so persistent as in the present species; the shell, also, is narrower, with a sub-conical and more elevated spire, and it never attains the size of *C. diadema*. The only other cocene tuberculated species at all resembling the present one, is *C. crenulatus* (Desh.); but in that species the shell is perspicuously furrowed, even in its mature state, and the spire is shorter and more conical.

Size.—Axis, 2 inches and 10-12ths (72 millim.); diameter, 1 inch and 8-12ths (42 millim.).

Locality.—Bracklesham Bay, where it is common.

No. 125. CONUS DEPERDITUS. *Bruguère*. Tab. XXV, fig. 2 *a—c*.

- D'Argenv.* 1742. *Conchyl. Append.*, 2d edit., p. 349, t. 29, fig. 8.
 ? *Walch.* 1768. *Traité des Petrifact.*, vol. ii, p. 102, t. 43, fig. 4.
Favanne. 1780. *D'Argenv.*, *Conchyl.*, 3d edit., t. 66, fig. G 1.
 CONUS DEPERDITUS, *Brug.* 1789. *Encycl. méth.*, vol. i, p. 691, No. 80, t. 337, fig. 7.
 — — — *Lamk.* 1802. *Ann. du Mus.*, vol. i, p. 386; vol. xv, p. 441, No. 6.
 — — — *Def.* 1818. *Dict. des Sci. nat.*, vol. x, p. 261.
 — — — *Lamk.* 1822. *Hist. Nat.*, vol. vii, p. 528, No. 6.
 — — — *Desh.* 1823. *Dict. class. d'Hist. nat.*, vol. iv, p. 388.
 — — — *Id.* 1824—37. *Descr. des coq. foss., &c.*, vol. ii, p. 745, t. 98, figs. 1, 2.
 — — — *Galeotti.* 1837. *Const. géog., &c.*, de Brabant, p. 148, No. 63.
 — — — *Bronn.* 1838. *Lethæa geog.*, vol. ii, p. 1118, t. 42, fig. 14. (ex plur. syn.)
 — — — *Sow.* 1841. *Min. Con.*, vol. vii, p. 25, t. 623, fig 5 (non figs. 1, 2).
 — — — ? *Nyst.* 1843. *Coq., &c.*, de Belg., p. 583, No. 501.
 — — — *Morris.* 1843. *Cat. Brit. Foss.*, p. 143.
 — — — *D'Orb.* 1850. *Prod. de Paléont.*, vol. ii, p. 355, No. 336.
 — — — ? *Bell.* 1851. (Foss. nummul. du Comté de Nice), *Mém. de la Soc. Géol. de France*, 2d ser., vol. iv, p. 219, No. 65.
 — ALLIONI? *Beyr.* (non *Michel.*) 1853. *Die Conchyl. des Norddeut. tertiär.*, p. 24, t. 1, figs. 4—6.
 — DEPERDITUS, *Roissy.* 1804. *Buff. Moll.*, vol. xlv, p. 409, No. 10.
 CONILITHES CINGULATUS, *Schlot.*? 1820. *Die Petrif.*, vol. i, p. 125, No. 3.

Nec CONUS DEPERDITUS,	Brocc.	1814.	Conch. Foss. Sub-app., vol. ii, p. 592, No. 10, t. 3, fig. 2.
nec — —	Bors.	1821.	Oritt. Piem., p. 14, No. 13.
nec — —	Brongn.	1823.	Terr. tert., &c., du Vicentin, p. 32.
nec — —	Bast.	1825.	Desc. des coq. foss., &c., de Bord., p. 39.
nec — —	Bronn.	1831.	Italiens tertiärgeb., p. 12, No. 5.
nec — —	Pusch.	1837.	Polens Palæont., p. 115, No. 2.
nec — —	Grat.	1838.	Cat. zool., &c., de la Gironde, p. 47, No. 422.
nec — —	Ib.	1838.	Tabl. statist. &c., de l'Adour, t. 19, No. 22.
nec — —	Ib.	1840.	Conchyl. foss., &c., de l'Adour, t. 2, figs. 18, 19.
nec — —	Sismon.	1847.	Synop. method., &c., Pedem. Foss., p. 44.
nec — —	Sow.	1850.	Dixon's Geol., &c., of Sussex, p. 108, t. 8, fig. 9.

C. testá turbinatá, elongatá, lævi, ad basin transversim obsolete sulcatá; spirá promi-nulá, acutiusculá: anfractibus numerosis, angustis, angulatis, marginibus posticis depressis, strias tenues concentricas gerentibus; ultimo anfractu regulariter conoideo, sursum dilatato: aperturá angustá; labro tenui, simplici, valde arcuato, postice profunde emarginato.

Shell oblong, turbate, with a moderately elevated mucronate spire, variable in height, but rarely exceeding a fourth part of the whole length of the shell, and terminating in a smooth, conical pullus, formed of three volutions; whorls numerous (10—12, exclusive of the pullus), bluntly angulated at the shoulders, nearly straight on the sides, with the posterior margins depressed, narrow, somewhat concave, and concentrically lined; the concentric lines are usually four or five in number, sharp, irregular, unequal, separated by moderately deep, rounded furrows, and frequently decussated by the lines of growth. In some specimens the early whorls are very finely tuberculated on the shoulders, and concentrically sulcated; the tubercles, however, disappear after the third or fourth volution, and the shoulders are afterwards smooth and simple: the concentric furrows also become gradually effaced on the posterior portion of the whorls as the shell approaches maturity, and ultimately are altogether lost, leaving only a few very obscure waved furrows traversing the base of the shell. The last whorl is conical, much attenuated in front, with nearly straight sides; the aperture is linear and narrow; the outer lip, which is thin, sharp-edged and much arched, presents a shallow but wide curvature at the posterior extremity.

M. Deshayes states that traces of the natural colouring are sometimes found in the French shells, consisting of narrow, transverse bands, occasionally interrupted by irregular, zigzag patches, following the direction of the lines of growth. Similar traces appear, though very rarely, in the English specimens.

This species appears to be confined to the middle eocene strata; for the shells from Ronca (Vicent.), described by Brongniart as *C. deperditus*, D'Orbigny regards as belonging to a distinct species, which he has named *C. Brongniartii*, and to this species the shells described by Bellardi from the nummulitic beds at Nice, probably are also referrible. Subsequent comparison has shown that specific differences also exist in the various shells from the more recent deposits which have been referred to the

present species. Thus the Sub-apennine shells, described by Brocchi, and those from Perpignan and Cassel, recorded by Sismonda, have been separated by Bronn under the name *C. Brocchii*; while to those from Dax and Gaas, described by Grateloup, M. D'Orbigny has given the name *C. Grateloupi*; and he has referred to the same species certain shells described by Pusch, to which Eichwald had given the name *C. argillæcola*. The cones described by Mr. Sowerby as belonging to the present species are young shells of *C. diadema*.

Dr. Beyrich ('Die Conchylien des Norddeutschen tertiärgebirges,' vol. i, p. 24) has described some shells from the North German tertiaries, which he has referred to *C. Allioni* (Michel.), but which agree so well with the present species, that it is difficult to separate them. That author states that, in *C. deperditus* of the Paris basin, the shells are comparatively wider, the concentric lines on the margins of the whorls more strongly marked, and the angles at the shoulders sharper than in the German specimens. These differences do not appear to be greater than may be fairly attributed to variations of local conditions, and I have therefore cited Dr. Beyrich's shell, but with a query. The English shells are wider, and appear to have attained a greater size, than the French shells; and the edges of the shoulders, instead of being somewhat sharp and elevated, as in the latter, are rounded or flattened obliquely; in all other respects our shells agree so well, that I have no doubt of their specific identity.

Size.—Axis, $2\frac{1}{2}$ inches, nearly (63 millim.); diameter, 1 inch and $\frac{5}{12}$ ths (36 millim.).

Localities.—Bracklesham Bay, Bramshaw (New Forest), at which places they are not uncommon. *French*—Grignon, Parnes, Mouchy, Courtagnon, &c. (fide *Desh.*) *Belgian*—Afflighem (fide *Galeotti*), Rouge-Cloître, Saint Josse-ten-Noode and Groenen-dael (fide *Nyst*). *German*—Westeregeln in Magdeburgh, Hermsdorf, Freinwalde and Buckow, and Freden, near Alfeld (fide *Beyrich*). *Italian*—La Palarca (fide *Bellardi*):

No. 126. CONUS VELATUS, Sowerby. Tab. XXIV, fig. 12.

CONUS VELATUS, *Sow.* 1841. Min. Con., vol. vii, p. 27, t. 623, fig. 7.

— — *Morris.* 1843. Cat. Brit. Foss., p. 143.

— — *Sow.* 1850. Dixon's Geol., &c., of Sussex, pp. 108 and 189, t. 8, fig. 17.

— — *Morris.* 1854. Cat. Brit. Foss., p. 244.

C. testá lævi, oblongá, turbinatá, antice sub-productá; transversim obsolete sulcatá; spirá conicá, prominulá, tridentem totius testæ longitudine paulo superanti: anfractibus angulatis, inermibus; marginibus posticis declivis, sub-concavis, lineas concentricas et rugas

curvas obliquas sese decussantes gerentibus, ad suturam incrassatis, plicatis: aperturá angustá; labro valde arcuato, postice late emarginato.

Shell smooth, oblong, turbinate, somewhat produced at the base, where it presents traces of transverse sulcation: spire conical, slightly elevated, barely exceeding in height a third part of the whole length of the shell: whorls narrow, angulated, and smooth round the shoulders; the posterior margins much depressed, very slightly concave, and presenting four or five rather coarse, raised, concentric lines, which are crossed and decussated by prominent, curved, wrinkle-like elevations, corresponding with the curvature in the outer lip; the edge is thickened, and presents a raised border round the suture, plicated by the extension of the marginal wrinkles over the surface. The aperture is narrow; the outer lip much arched, and separated from the suture by a wide, moderately deep curvature. The surface of the shell is much eroded, and the lines of growth are consequently more conspicuous than is usually the case; these, with the decussated lines on the spire, "give the shell," Mr. Sowerby says, "the appearance of having been enclosed in a net or net-veil; whence the name."

The specimen from which the figure is taken, and on which the species was founded, forms part of Mr. Bowerbank's collection, and is, I believe, unique. In the general character the shell resembles *C. deperditus*; but the more elevated posterior margins, the thickened and plicated edges of the whorls in the present species, apparently justify the separation.

Size.—Axis, 1 inch and 4-12ths; diameter, 5-12ths of an inch.

Locality.—Bracklesham Bay.

No. 127. *CONUS LAMARCKII*, *F. E. Edwards*. Tab. XXV, fig. 3 *a—c*.

CONUS ANTEDILUVIANUS, *Desh.* (nec *Brug.*, nec *Lam.*) 1824—37. *Descr. des coq. foss.*, &c., vol. ii, p. 749, t. 98, figs. 13, 14.

— — *Bronn.* 1838. *Lethæa Geog.*, p. 1118.

— *DEPERDITUS*, *Sow.* (non *Brug.*), 1850. *Dixon's Geol.*, &c., of Sussex, p. 108, t. 8, fig. 9.

— *ANTEDILUVIANUS*, *D'Orb.* 1850. *Prod. de Paléont.*, vol. ii, p. 355, No. 335.

— *CONCINNUS*, *Phil.* (non *Sow.*) 1846. *Tert. foss. Magdeb.* (*Paleont.*, vol. i, p. 80, No. 183).

— — *Beyr.* (non *Sow.*) 1853. *Die Conchyl. des Norddeutsc. tertiärg.*, vol. i, p. 21, t. 1, fig. 2.

C. testá oblongo-turbinatá, lævi, ad basin transversim sulcatá; spirá elevatá, acuminatá, trientem totius testæ longitudine superanti: anfractibus angustis, nodulosis, marginibus posticis oblique depressis, sub-concavis, ad suturam tenuiter plicatis; anfractu ultimo conico: aperturá lineari, angustá; labro tenui, arcuato, postice emarginato.

Var. FILIFER. *Testá latiori; marginibus posticis anfractuum concentrice lineatis; lineis irregularibus, aliquando granulatis.*

Shell oblong, inversely conical, smooth, with an elevated, nearly conical spire, in height a little exceeding a third part of the whole length of the shell, and terminating in a small pointed pullus of three volutions. The whorls, 8—10 in number, exclusive of the pullus, are narrow, angulated at the shoulders, the posterior margins slanting backwards towards the preceding whorl, and concave; the sutural edge finely plicated by the strongly marked lines of growth. The early whorls present on the shoulders a row of small rounded tubercles, which are continued, more or less, on the later whorls, in different individuals. The aperture is straight and narrow; the outer lip thin, sharp-edged, not much arched, and separated from the suture by a wide, shallow curvature.

In the specimens from Bracklesham Bay, forming the variety *filifer*, the shells are wider than in the type, the posterior margins of the whorls present concentric lines, variable in number, and occasionally finely granulated where they are decussated by the lines of growth, and a single row of very small, bead-like knobs runs round the sutural edge, instead of the plication usually found there, in this respect somewhat resembling *C. concinnus*. The specimens from Bramshaw agree better with the French shells than do those from Bracklesham Bay; in the latter the shells generally are somewhat wider, the tubercles on the angles of the whorls disappear more early, and the shoulders are blunter than in the typical form. I regard these differences, however, rather as merely local variations than as sufficient to justify the separation of the shells from the present species, with which they agree in the elevated spire, the slanting concave margin and crenulated edge of the whorls, and the size of the shell itself.

With regard to the nomenclature of the French shell, much confusion has arisen, the origin of which is explained by M. Deshayes in a note in the 2d edition of Lamarck's 'Histoire Naturelle' (vol. xi, p. 155). From this it appears that the shell described by Bruguière as having been found at Courtagnon, and to which he gave the name *C. antediluvianus*, was, in fact, a Sub-apennine shell, and that Lamarck, misled by this, quoted *C. antediluvianus* as a Paris-basin species in his Mémoire, published in the 'Annales du Musée.' In 1814, Brocchi, in his work, applied the name given by Bruguière to the Sub-apennine shells, to which it strictly and properly belongs; but Lamarck, in 1822, in the first edition of his 'Histoire Naturelle,' again recorded Bruguière's species as occurring in the environs of Paris. Subsequently, M. Deshayes, in his 'Description des coquilles fossiles,' &c., pointed out the fact that Bruguière's description referred to an Italian species not found in the Paris basin; but unfortunately, in describing the French Eocene shells, he applied Bruguière's name to them. Bronn also, in the 'Lethæa Geognostica,' retained the name *C. antediluvianus* for the Paris-basin species, erroneously associating it with *C. concinnus* (Sow.), a species perfectly distinct; and he proposed the specific name *C. Apenninicus* for the Sub-apennine shells. The same author subsequently, in his 'Index Palæontologicus,' again united

the so-called *C. antediluvianus* of the Paris basin with the English *C. concinnus*, retaining for them the name of the latter. It is obvious that the name *antediluvianus* belongs to the Sub-apennine shell, and cannot be applied correctly to the French eocene species; and the attempts of MM. Bronn, Nyst, and others to remove the difficulty by giving a new name to the Italian species, can but increase the confusion. Dr. Beyrich, who fully appreciated the specific distinctness of the forms, has observed ('Die Conchyl.,' &c., p. 20), that "there will not be any necessity for a new name for the older eocene species of the Calcaire Grossier if the union proposed by Bronn be adopted." In the description of *C. concinnus*, I have stated the characters in which I consider that species to be perfectly distinct; and it is a cone which, although recorded by Mr. Sowerby as occurring at Barton, is, I believe, peculiar to the older eocene strata, and cannot be associated with the present species. It becomes necessary, therefore, to give a new name to the middle eocene species, and I propose to distinguish it as *C. Lamarckii*.

Size.—Axis, 1 inch and 7-12ths (40 millim.); diameter, 9-12ths of an inch, nearly (18 millim.).

Localities.—Bracklesham Bay, Bramshaw. *French*—Parnes, Mouchy, Courtagnon (fide *Desh.*); Vaudancourt, Hermes (fide *D'Orb.*).

No. 128. *CONUS CONCINNUS*, Sowerby. Tab. XXIV, fig. 13 *a—c*.

CONUS CONCINNUS, Sow. 1821. Min. Con., vol. iii, p. 180, t. 302, fig. 2.

— — *Morr.* 1843. Cat. Brit. Foss., p. 142.

— — *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 356, No. 337.

Nec — — *Phil.* 1846. Tert. Foss. Magdeb. (Palæont., vol. i, p. 80, No. 183).

nec — — *Beyr.* 1853. Die Conchyl. des Norddeutsc. tertiärg., vol. i, p. 21, t. 1, fig. 2.

C. testá elongato-turbinatá, lævi, ad basin concentrice sulcatá; spirá elevatá, sub-conica: anfractibus angustis, sub-planis, angulatis, ad angulos nodulosis; marginibus posticis declivis, duas vel tres lineas elevatas granulatas gerentibus, ad suturas marginatis, plicatis vel moniliferis: aperturá angustissimá; labro valde arcuato, postice late emarginato.

Var. β. Testá spatiis inter suturas et angulos anfractuum tres vel quatuor lineas elevatas simplices gerentibus.

Shell elongate, turbate, concentrically furrowed at the base; spire elevated, but variable in height, sometimes nearly equalling a half, sometimes not much exceeding a third part, of the whole length of the shell: whorls seven or eight, exclusive of the pullus, very narrow, nearly straight on the sides, angulated at the shoulders, with the posterior margins slanting backwards; the edges round the suture thickened, and either plicated or furnished with a single row of rather small bead-like nobs; the space

between the edge and the shoulder is straight, and ornamented with two or three concentric raised lines, very finely granulated. The shoulders bear a single row of prominent, round tubercles, placed at regular and not distant intervals, and continued throughout. The aperture is straight, and very narrow; the outer lip much arched, and presenting a wide, shallow curvature at the posterior extremity. The concentric furrows cover the whole surface of the young shell, but become more or less effaced as the shell is enlarged, and on the last whorl they are confined to the anterior portion of the shell; through all stages of growth the basal furrows are deep and sharp-edged.

A variety occurs at Lee, near Southend, in which the sutural edge and margin of the whorl present four thick, prominent lines, rounded and smooth on the upper surface, and devoid of the granulations which characterise the type.

I have already noticed the fact, that Bronn has regarded the present species, apparently confined to the lower eocene strata, as identical with the so-called *C. antediluvianus* of Lamarek; and Dr. Beyrich, adopting that opinion, has applied the name *concinus* to a shell from the German Tertiaries which belongs to *C. Lamarckii*. The narrower form, the smaller number of the volutions, the large rounded tubercles on the shoulders, the more depressed margins of the whorls, with their thickened edges and concentric rows of granulations, or strong elevated lines, and the deep, sharp-edged furrows, barely effaced on the posterior part by the outer coating of the shell,—appear to me sufficiently to distinguish the present shells from those of the middle eocene epoch. I do not agree, therefore, with M. Bronn and Dr. Beyrich, in referring both to the same species; and in this view, apparently both M. Deshayes and M. D'Orbigny concur.

Size.—Axis, 1 inch and 3-12ths (32 millim.); diameter, rather more than 6-12ths of an inch (between 13 and 14 millim.).

Localities.—Highgate; Fortress Green, near Kentish Town; Lee, near Southend. Mr. Sowerby cites Barton, but I have never met with any specimen from that locality; and the specimen on the authority of which Barton is cited ('Min. Con.,' t. 302, lowest fig.) does not present the characteristic form of *C. concinus*; it is much mutilated, but it has rather the appearance of a worn specimen of *C. scabriculus*. M. Deshayes (2d edit. of 'Lam. Hist. Nat.') states that this species occurs in the environs of Paris; it is not mentioned, however, in his 'Description des Coquilles Fossiles,' and M. D'Orbigny has not given any French locality for it. At present this cone appears to belong exclusively to the earlier eocene fauna.

No. 129. *CONUS SCABRICULUS*, Solander. Tab. XXIV, fig. 9 *a—c*.

		<i>CONUS SCABRICULUS</i> , Sol. 1766. Brand., Foss. Hanton., p. 15, t. 1, fig. 21.
—	—	<i>Sow.</i> 1821. Min. Con., vol. iii, p. 180, t. 303, figs. 1, 2.
—	—	<i>Desh.</i> 1824-37. Descr. des coq. foss., &c., vol. ii, p. 751, t. 98, figs. 17, 18.
—	—	<i>Ib.</i> 1845. Lam., Hist. Nat., 2d edit., vol. ii, p. 158, No. 11.
—	—	<i>D'Orb.</i> 1850. Prod. de Paléont., vol. ii, p. 416, No. 1472.
non	—	<i>Sism.</i> 1847. Syn. Meth., &c., Pedemont. foss., p. 44.

C. testá utrinque conicá, antice sub-productá, lineis concentricis, elevatis, ornatá; spirá elevatá, acuminatá; lineis concentricis acutis, denticulatis, aliquando confertis, aliquando distantibus; alternis sæpissime minoribus, sæpe inermibus: anfractibus planis, postice obtuse angulatis; marginibus sub-concavis, ad suturam granulosi: aperturá lineari, angustá, bessem totius testæ paullum superanti; labro tenuissimo, leviter arcuato, postice sinuoso.

Shell oblong, doubly conical, slightly produced at the base, and ornamented with concentric raised lines; spire elevated, pointed, terminating in a very small conical pullus, formed of three smooth volutions. The concentric lines are sharp, and very variable in their character; sometimes numerous, sometimes distant, and very frequently the alternate lines are smaller than the others. Most generally the concentric lines rise, at regular intervals, into short, tooth-like tubercles, having their bases prolonged, both in front and behind, into short, rounded ribs, more or less prominent according to the size of the tubercles, and separated by deep, pit-like hollows. The whorls, exclusive of the pullus, are six or seven in number, flat at the sides, slightly contracted towards the base, obtusely angulated at the shoulder, longitudinally ridged by regular conspicuous lines of growth, and bordered at the suture by a row of small granulations; the space between the shoulder and the suture is traversed by two or three smooth, prominent lines. The aperture is straight, narrow, slightly emarginate in front, and in length, rather more than two thirds of the whole shell; the outer lip is smooth within, thin, sharp on the edge, of a flattened elliptical form, and separated from the preceding whorl by a moderately wide, but not deep, sinus. The columella is slightly curved inwards.

Not infrequently, the alternate smaller lines, where they do occur, are smooth and simple; and the same character sometimes, although very rarely, distinguishes the whole transverse lineation. In the latter instances the surface of the shell between the raised lines is flat and smooth, except where it is ridged by the lines of growth.

This pretty and well-marked species is, apparently, confined to the middle eocene strata; and the shells referred to it by Sismonda, from Piedmont and Turin, are considered by M. D'Orbigny to belong, in fact, to Michelotte's *C. ornatus*.

Size.—Axis, 4-5ths of an inch; diameter, rather more than 3-10ths of an inch.

Localities.—Barton. *French*.—Monneville (fide *Desh.*), Chavançon (fide *D'Orb.*).

No. 130. CONUS LINEATUS, Solander. Tab. XXIV, fig. 10 a—c.

- CONUS LINEATUS, Sol. 1766. Brand., Foss. Hanton., p. 15, t. 1, fig. 22.
 — CORCULUM, Sow. 1841. Min. Conchol., vol. vii, p. 27, t. 623, figs. 8, 9.
 — LINEATUS, Morris. 1843. Cat. Brit. Foss., p. 143.
 — CORCULUM, Morris. 1843. Cat. Brit. Foss., p. 142.
 — — Sow. 1850. Dixon's Geol., &c., of Suss., p. 109.
 — LINEATUS, D'Orb. 1850. Prod. de Paléont., vol. ii, p. 355, No. 334.
 — — Morris. 1854. Cat. Brit. Foss., 2d edit., p. 244.
 — CORCULUM. Ib. 1854. Cat. Brit. Foss., 2d edit., p. 243.
 non — LINEATUS, Chemn. 1795. Conchyl. Cab., vol. x, p. 27, t. 138, fig. 1285.

C. testá utrinque sub-conicá, lineis concentricis ornatá, antice sub-productá; lineis concentricis æqualibus, lævibus, confertis; spirá elevatá, acuminatá, sub-nodulosá: anfractibus planis, postice obtuse angulatis, marginibus sub-concavis, concentrice lineatis, ad suturam depressis, granulatis: aperturá lineari, angustá, longitudine bessem totius testæ fere æquantí; labro tenuissimo, leviter arcuato, postice sinuato.

Shell oblong, doubly conical, ornamented with transverse raised lines; spire elevated, coronated, terminating in a small pointed pullus, consisting of two or three smooth volutions; the transverse lines are smooth, regular, numerous, and separated by rather deep, rounded furrows; the whorls, which are five or six in number without the pullus, are flat at the sides, slightly contracted and produced in front, angulated at the shoulders, and depressed at the sutural margins, forming a narrow ledge running round the spire, the outer edge of which is finely granulated; the space between the margin and the shoulder is slightly concave, and presents two or three faint, concentric, unequal, raised lines. The early whorls bear on the shoulders a row of transverse, oblong tubercles, imparting a somewhat nodulous character to the spire, but lost on the last whorl, the shoulder of which is smooth. The aperture is straight, narrow, and about two thirds of the whole shell in length; the outer lip, which is but slightly curved, presents a shallow sinus at the posterior extremity: the columella is nearly straight.

Brander's shell, deposited in the British Museum, is unfortunately mislaid, and I have not been able to compare with it the shells now described. They agree, however, with Solander's description and figure in all respects except in the striation. Brander's shell, which was apparently a larger and an older specimen than any I possess, and was probably somewhat worn, is described as *obsolete striata*; while the transverse lines on my specimen are generally bold and clearly defined.

The Bracklesham Bay shell, described by Mr. Sowerby as *C. corculum*, is a little shorter in the spire; but, in all other respects, it agrees exactly with the present species, to which, therefore, I have referred it.

Lamarek, and, since his time, MM. Deshayes and D'Orbigny, have considered *C. lineatus* as identical with *C. stromboides* (Lamk.), from the Paris basin. These two shells do not appear to me, however, to be referable to the same species, for in the French species the shell is narrower, the spire more elevated, and formed of more numerous volutions; the whorls, also, are more rounded at the shoulders, the transverse lineation is feebler and more irregular, and the outer lip is more strongly arched than in the English shells. I have, therefore, not cited *C. stromboides* as a synonym of the present species.

So closely does *C. lineatus* resemble *C. scabriculus*, from which, in fact, it is only distinguished by its smooth, crowded, concentric lines, separated by rounded furrows, that it ought, perhaps, to be regarded as merely a variety into which the smooth lined specimens of the latter species would lead; but, without an examination of Brander's shell, I do not venture to question Solander's species.

Size.—The dimensions of my largest specimen are—axis, 7-12ths of an inch; diameter, rather more than 3-12ths of an inch: those of Brander's shell were, according to the figure—axis, 10-12ths of an inch; diameter, rather more than 5-12ths of an inch.

Localities.—Barton, Bracklesham Bay. Very rare.

Section—CONORBIS.

No. 131. CONUS DORMITOR, Solander. Tab. XXIV, fig. 11 a—c.

CONUS DORMITOR,	Sol.	1766.	Brand., Foss. Hanton.,	p. 16, t. 1, fig. 24.
—	—	Sow.	1821. Min. Con.,	vol. iii, p. 179, t. 301.
—	—	Morris.	1843. Cat. Brit. Foss.,	p. 143.
—	—	D'Orb.	1850. Prod. de Paléont.,	vol. ii, p. 356, No. 338.
—	—	G. Sow.	Gen. of Shells,	Conus, fig. 8.

C. testá crassiusculá, fusiformi; utrinque conicá, concentrice lineatá, antice sub-productá, vix emarginatá, paulo retroflexá; lineis concentricis elevatis, æqualibus, irregularibus, sub-distantibus; interstitiis concavis, lineis incrementi tenuissime crenulatis: aperturá lineari, angustá; labro acuto, rotundato-elliptico, intús incrassato, postice late sinuato; labii margine anteriori elevatá, productá.

Var. SEMINUDA. Testá ad basin transversim sulcatá; anfractibus postice unico sulco exaratis, cæterum lævibus.

Shell rather thick, fusiform, resembling two nearly equal cones, placed base to base, and ornamented with concentric raised lines; the spire, forming the shorter cone, is elevated, pointed, and terminates in a very small conical pullus of three volutions; whorls

seven or eight, exclusive of the pullus, rounded at the shoulders, nearly straight on the sides, somewhat produced in front, and very slightly bent backwards. The concentric lines are equal, not very distant over the middle of the whorls, but varying in that respect in different individuals; more crowded at the base and on the shoulders, distant on the posterior margins, which are much elevated, and pressed against the preceding whorls; occasionally on the last whorl of mature specimens additional faint lines appear. The spaces between the lines are very slightly concave, and finely crenulated by the lines of growth, which are very perspicuous over the whole surface of the shell. The aperture is narrow, straight, except at the base, where it is a little deflected, and scarcely emarginate; the outer lip thin and sharp on the edge, very much thickened within, faintly crenulated on the inner margin by the concentric lines, of a roundedly elliptical shape, and detached from the suture by a wide but very shallow curvature. The anterior margin of the columellar lip is elevated and prolonged in front, where it serves as the wall of the rudimentary anterior canal formed by the produced base of the shell.

In specimens from Brockenhurst and Lyndhurst, the middle and upper parts of the whorls are perfectly smooth, with the exception of a single furrow which traverses the posterior margins; and the base of the shell presents numerous shallow furrows, which extend almost up to the middle of the whorl, instead of the sharp elevated lines which characterise the typical form.

This well-known species, peculiar, I believe, to the Hampshire basin, forms the type of Mr. Swainson's genus *Conorbis*. In the elevated conical spire, the almost semicircular form of the outer lip, and the produced base of the whorls, it presents the closest analogies with that section of the *Pleurotomæ* formed of *P. prisca*, *P. amphiconus*, *P. linearis*, and similar species. Indeed, so closely does it approach to some of these, that, judging from external characters only, it is difficult to decide to which genus it should be referred. The straight, narrow aperture, however, is certainly that of a cone, and indicates a necessity that the animal, in order that it might withdraw into the inner whorls, should be enabled to enlarge the space within the shell; a necessity which, as I have already stated, was met by the power of absorption possessed by the animal. The curvature in the outer lip, also, is quite distinct in its character from the sinus in the outer lip of the *Pleurotomæ*.

Size.—Type—Axis, 1 inch and 1-12; diameter, 5-12ths of an inch. Var.—Axis, 1 inch and 3-12ths; diameter, 6-12ths of an inch.

Localities.—Barton, Alum Bay (No. 29, *Prestwich*), Lyndhurst, and Brockenhurst (New Forest).

No. 132. *CONUS ALATUS*, *F. E. Edwards*. Tab. XXV, fig. 1 *a, b*.

C. testá sub-fusiformi, utrinque conicá, concentrice sulcatá, antice sub-productá, retro-flexá, emarginatá; spirá acuminatá, in longitudine trientem totius testæ superanti: anfractibus convexiusculis, sub-angulatis; marginibus posticis angustis, concavis, concentrice sulcatis; sulcis concentricis irregularibus, postice evanescentibus: aperturá angustá; labro aliformi, fere semicirculari, acuto, intús incrassato, antice crenulato, postice perparum breviterque emarginato; labio antice reflexo, producto.

Var. HEMILISSA. Testá breviori, latiori, postice lævi; marginibus anfractuum valde cavatis, unico sulco concentrico exaratis.

Shell nearly fusiform, doubly conical, concentrically furrowed, rather produced and bent backwards at the base, and deeply notched; the concentric furrows are irregular, crowded, and sharp-edged over the base, more distant and obscure as they ascend the shell; the spire is pointed, elevated, rather more than a third part of the whole shell in height, and terminates in a very small, conical pullus. The whorls are rather convex, slightly angulated at the shoulder, and a little thickened on the edge round the suture; the posterior margin is narrow, rather concave, and traversed by two or three deepish furrows. The aperture is narrow and nearly straight, with the anterior extremity slightly curved outwards and backwards; the outer lip is remarkably large, almost semicircular, thickened within, thin and sharp on the edge, and separated from the suture by a very small but rather deep curvature; the inner lip produced, reflexed, and curved backwards; the columella presents a broad, elevated ridge or "crest" in front.

A variety occurs at Brockenhurst, in which the shell is shorter and wider; the posterior portion of the whorl is smooth; the angle on the shoulder sharper and more clearly defined, and the posterior margin more concave, and traversed by a single obscure furrow.

The presence, in this species, of concentric furrows instead of the sharp, elevated lines which characterise *C. dormitor*, is not a character to which much specific value can be attached, as these ornaments interchange by insensible degrees; but the depressed, concave posterior margin of the whorls, the very large wing-like, outer lip, the small, narrow, but deep curvature which separates the outer lip from the suture, and the deep anterior notch, with its usual accompaniment, the elevated crest on the columella, appear to me to justify the separation of the present species. Even the variety which, with its half-smooth half-sulcated surface, so much resembles the *var. seminuda* of *C. dormitor*, is easily distinguishable by these characters.

Size.—Type—Axis, 1 inch and 5-12ths, nearly; diameter, rather more than 6-12ths of an inch. Variety—Axis, 1 inch; diameter, $\frac{1}{2}$ inch.

Localities.—Type: Bramshaw. Variety: Brockenhurst, Lyndhurst.

Genus 26th. PLEUROTOMA.* *Lamarck.*TURRIS, 1797, *Humphreys.*PLEUROTOMA, 1801, *Lamarck.*PLEUROTOMARIUS, 1806, *Dumér.*PLEUROTOMUS, 1810, *De Montf.*TURRICULA, 1817, *Schum.* (not *Klein*).PLEUROTOMA, 1840, *Swainson.*— (exc. sect. A) 1847, *Bellardi.*SURCULA, 1853, *Adams.*GENOT, 1757, *Adanson.*CRASSISPIRA, } 1840, *Swains.*
BRACHYTOMA, }CONOPLEURA, 1844, *Hinds.*GENOTA, 1853, *Adams.*Sect. DRILLIA, 1834, *Gray.*

Gen. Char.—*Shell* fusiform, turreted, or conoid, ribbed or concentrically striated, sometimes smooth; spire elevated: aperture oval, terminating anteriorly in a canal more or less elongated; outer lip thin, with a deep fissure or notch near the posterior extremity; columella smooth, nearly straight. *Operculum* pointed, nucleus apical.

This genus, first indicated by Humphreys under the name *Turris*, was established by Lamarck for various shells, which by Linnæus, Chemnitz, and others, had been placed with *Murex*, and by Brugnière with *Fusus*. The animal is very similar to that of the *Cone*, and, like it, presents a strong resemblance to those of the *Muricidæ*, from which it is mainly distinguished by the peculiar character of the dentition. It has a small, flat head, provided with a siphon varying in length, and with cylindrical tentacles wide apart, on bulgings near the bases of which the eyes are placed; and the mouth terminates in a small, fleshy proboscis. The foot is oblong, truncated at each extremity, of nearly uniform width, and thin at the edge; and the mantle has a notch or slit on the right side which corresponds with, and is represented by, the sinus in the shell. The function attributed to this notch is the more ready expulsion of the excretory matter, but the precise way in which it is subservient to that purpose is not known. Apparently it is intended, as Mr. Swainson asserts, for the protrusion of some particular organ of the animal; but the existence of such an organ is not noticed by MM. Quoy and Gaimard in their description of the anatomy of the animal of *Pleurotoma Babylonica*, nor has it as yet been ascertained. The lingual teeth are elongate, subulate, arranged in two series; but, as in the *Cone* animal, the central or rachidian teeth, usually found in other families, are wanting.

* Etym. Πλευρά, the side; and Τομή, an incision.

When Lamarek first established the present genus, he at the same time separated the species whose shells terminate in a short canal, under the name *Clavatula*, a genus which, as defined by the author, rested wholly on characters taken from the shell, and which was afterwards withdrawn by him as not tenable. In this suppression subsequent writers have concurred until recently, when, a better knowledge of the animal having been acquired, characters have been pointed out which are generally considered as sufficient to justify the separation, and the genus has accordingly been adopted, and has been re-defined by Dr. Gray. The most prominent of these characters are the shape of the foot, which is large and ovular, and the condition of the operculum, the nucleus of which, instead of being apical as in the true *Pleurotoma*, is placed nearly at the middle of the right margin. The shell also, it must be observed, presents an emargination near the anterior extremity of the outer lip, similar to that found among the *Strombidae*, and a thick callosity at the hind part of the columella near the suture, characters which are not found in the present genus.

The genus *Pleurotoma*, as originally defined, comprised a large number of species, and the list of synonyms shows how strongly the necessity for some subdivision has been felt. Some of the proposed divisions, however, so far as the present imperfect knowledge of the animals will enable the student to estimate their value, appear to rest on conchological distinctions, and as yet are not generally accepted. In others, however, the animals exhibit distinct characters, which, taken in conjunction with modifications of the shells, are received as of sufficient generic value. Thus in *Bela* (Leach), the eyes are placed on the upper part of the tentacles, which are approximate, and the outer lip of the shell is simple, or with a slight sinus confluent with the suture; and in *Mangelia* (Leach; *Defrancia*, Millet; *Raphitoma*, Bellardi), the eyes are sub-pedicelled, the foot is short, tapering behind, and enlarged in front at each corner into a hook-shaped projection, and the dentition, according to Messrs. Forbes and Hanley, presents a simple rachidian tooth in addition to the two lateral subulate teeth of the present genus; the animal, also, is without an operculum, and the outer lip of the shell has a sinus resembling that found in the notched species of *Bela*.^{*} Again, in *Perrona* (Schum.; *Tomella*, Swains.), the nucleus of the operculum is placed near the middle of the right side, as in *Clavatula*, of which genus, in fact, it appears to be only a smooth form; and again, in *Drillia* (Gray), according to Messrs. Adams, the eyes are placed near the lips of the tentacles, which are very slender and approximated, and the outer lip presents a small sinus in front, like the one in *Clavatula* already noticed. A more extended knowledge of the animals may hereafter support others of the proposed genera; but, in the mean time, they can be received only as subdivisions for facilitating the arrangement of the very numerous species which crowd the present genus.

* Messrs. Forbes and Hanley have united *Mangelia* and *Bela*, using the latter name to distinguish the operculated species from those without an operculum, which, with those authors, form the true *Mangelia*.

With regard to the genus *Clavatula*, several shells are found among the English eocene *Pleurotomæ*, which, agreeing with Lamarck's definition of the genus, might be, perhaps correctly, referred to it; but since that genus, as re-defined, depends on zoological characters, and on the condition of the operculum, criteria which are not available to the palæontologist, and the species themselves do not exhibit any characters by which they can be separated from the true *Pleurotomæ*, those shells have been referred, in the following descriptions, to the present genus.

Bellardi, in his elaborate and most useful work, 'Monografia delle Pleurotome fossile del Piémonte,' has divided the *Pleurotomæ* into three genera, *Pleurotoma*, *Borsonia*, and *Raphitoma*. The first comprises the true *Pleurotomæ* and the *Clavatulæ* of Lamarck; and with these are associated some fusiform shells generally referred to *Fusus*, the outer lips of which present, not the true notch or slit characteristic of a *Pleurotoma*, but a wide undulation, which the author regards as a "rudimentary sinus." No other reason is assigned, and this certainly does not appear to be a sufficient one, for placing the shells in question in the present genus. Several of the so-called eocene *Fusi* present this undulation in the outer lip; and inasmuch as to refer them to the present genus would, in my opinion, uselessly create much confusion, I have left them among the *Fusi*, where they were first placed. The second genus, *Borsonia*, is proposed for certain shells in which the true sinus of a *Pleurotoma* is associated with a fold on the columella.* The remaining genus, *Raphitoma*, consists of those species in which the sinus is very small and confluent with the suture, and the canal is indistinct, a division which corresponds pretty accurately with *Mangelia* (Leach). The *Pleurotomæ* are again divided into three sections, according to the size and shape of the sinus; namely, *Pseudotomatæ*, or false-notched shells, composed of the fusiform species before mentioned, in which the outer lip presents the so-called rudimentary sinus; *megatomatæ*, or widely-notched shells;† and *macrotomatæ*, or deeply-notched shells. The last section is again sub-divided into five groups; *delloideæ*, in which the canal is but little produced, and the sinus is placed in an angular depression; *pteroideæ*, in which the canal is elongated, the outer lip aliform and produced in front, and the sinus is in a depression; *cariniferæ*, having the canal as long as the spire, and the sinus on a keel; *excavatæ*, in which also the canal is as long as the spire, but the sinus is between the shoulder and the suture; and *hemicycloidales*, having the canal indistinct, and the sinus semicircular, and placed in a depression.

Although this classification will render great assistance in the study of the present

* Shells referable to this division, as enlarged by Rouault, occur in our middle eocene strata; the genus *Borsonia* will therefore be noticed in its proper place.

† Bellardi cites *Tomella*, Swains., as corresponding with his section *Megatomatæ*; that section, however, consists of two species only, *P. cataphracta*, Broc., and *P. ramosa*, Bast., in both of which the shells are many whorled, turreted, coronated, and concentrically striated, and therefore do not at all agree with Mr. Swainson's definition of his genus *Tomella*.

genus, the distinctions between some of the groups will, I think, be found to be difficult of practical application; nor will the groups proposed embrace all the forms which occur in the English eocene fauna. The employment of a few broadly marked characters, which the eye can readily seize, will afford, in fact, more effectual aid to the student; and with this view I have adopted the division of the *Pleurotomæ*, proposed by M. Deshayes, into *fusiformes* and *conoidales*; but the *fusiformes* I have divided into two sections, distinguished by the position of the sinus, a prominent and unvarying character; while the size and, to some extent, the shape of the sinus are subject to modification. The first section will comprise the species in which the sinus is placed in the margin, that is to say the space between the suture and the shoulder, or widest part of the whorl; the second section will embrace those in which the sinus is placed on the shoulder of the whorl. Each of these sections will be sub-divided into two groups, respectively consisting of the species having the canal produced, and the species in which the canal is short or indistinct.

The genus *Pleurotoma* is one of peculiar interest; it seems to form a central group, in which either the animals present close affinities with those of the neighbouring genera, or the shells, radiating through aberrant forms in which the typical characters are prominently retained, present striking analogies with those of apparently distant genera; analogies which, if not suggestive of affinities, at least show the repetition of similar forms in dissimilar groups. Thus the passage from the true fusiform *Pleurotoma* through the conoidal forms of that genus into the species of *Cone* forming the section *Conorbis*, and so into the true Cones, is a transition so gradual and so perfect as in itself to afford the strongest evidence of the intimate connection of the present genus with the Conidæ. So, again, the passage through *Lachesis* into *Murex*—that through the shells before referred to with the so-called rudimentary sinus in the outer lip into the true *Fusus*; and also that through *Borsonia* into *Turbinella* or *Fasciolaria*; while the short posterior canal in the species forming Swainson's genus *Brachytoma*, and the anterior notch on the outer lips of the *Drillia*, present strong resemblances to the *Strombidæ*.

The living species of *Pleurotoma* are very numerous, upwards of 450, including those forming the different sub-genera, having been described: they are found in all parts of the world, but principally in the seas of China and Western America, ranging in depth from low-water mark to 100 fathoms. In the fossil state they first appear in the upper cretaceous strata, from which four species referred to this genus have been described by Goldfuss, Sowerby, and D'Orbigny. During the tertiary epoch the genus was largely developed; upwards of 90 species, from the eocene formations of Europe, have been described by Lamarck, Sowerby, Deshayes, Melleville, and other writers; while from the more recent formations nearly 200 species have been recorded by Brocchi, Grateloup, Basterot, De Koninck, Nyst, Bellardi, Sowerby, S. Wood, Hörnes, and the many other authors who have described the mollusca of the newer

tertiary deposits. In the Western hemisphere, which presents a large proportion of the living species, the genus does not appear to have had so large a development; twenty-three species only from the tertiary deposits in the United States have been described by Conrad and Lea, and three species from the newer tertiaries of Chili have been described by Sowerby. The genus is largely represented in the English eocene fauna, but as yet comparatively few species have been described or identified.

The shells of the *Pleurotomæ* appear to have been peculiarly subject to modification by external conditions, and, as De Blainville has remarked, it is "apparently with them as with the *Cerithia*, the *Ammonites*, and other genera which contain many species; each locality presents different forms."

Section I. Shells fusiform.

A. Sinus in the posterior margin of the whorl.

a. Canal elongated.

No. 133. *PLEUROTOMA STENA*, F. E. Edwards. Tab. XXV, fig. 4 *a*, *b*.

P. testá elongato-fusiformi, angustá, sub-turritá, fasciis et filis spiralibus, lineis incrementi decussatis, omnino tectá; spirá productá, apice acuminato: anfractibus converiusculis, angulatis, obtuse carinatis, postice sub-concavis, ad suturam crenulatis; filis concentricis numerosis, inæqualibus; anfractu ultimo antice gradatim attenuato et in canali longo, recto, exeunti: aperturá elongato-ovali; labro vix arcuato; sinu labrali angusto, profundo in margine collocato.

Shell elongate, fusiform, narrow, ornamented with numerous spiral bands, the spaces between which, as well as the surface between the shoulder and the suture, and sometimes even the spiral bands, are covered with numerous fine, thread-like, unequal, raised lines, decussated, or rather roughened, by the lines of growth; the spire, which is formed of seven or eight volutions, is much produced; the whorls are slightly convex, sharply angulated at the shoulder; the posterior margins depressed and slightly thickened at the edge, where one or two raised lines, stronger than the others, and crenulated by the lines of growth, run round the suture; the space between the suture and the shoulder is concave, giving somewhat of a turreted aspect to the spire. The spiral bands are irregular, narrow, flat on the surface, sharp edged; the posterior band runs round the shoulder, forming a blunt keel, and the space between it and the band immediately in front of it is wider than those between the other bands, and is concave; the bands, as they approach the anterior part of the shell, become closer, narrower, and less prominent, while, on the other hand, the concentric lines become stronger, more elevated, and more distant, until the two blend together, and form the round, coarse, raised lines which cover the base of the shell

and the canal. The body whorl is gradually much attenuated in front, and terminates in a long, nearly straight canal. The aperture is of a lengthened oval shape; the outer lip slightly arched; and the sinus, which is in the middle of the margin, is narrow and deep.

The young shell of the present species presents some resemblance to the variety *Pagoda* of *P. terebralis*; but the latter shell is proportionably wider and shorter, and is distinguished as well by the smooth posterior margins of the whorls as by the sharp-edged keel, which is turned upwards, forming a deep channel round the margin.

Size.—Axis, 2 inches and 10-12ths; diameter, 8-12ths of an inch.

Localities.—Highgate, Clarendon Hill, Shenfield, and Southampton.

No. 134. *PLEUROTOMA INARATA*, *Sowerby*. Tab. XXV, fig. 6.

PLEUROTOMA INARATA, *Sow.* 1850. *Dixon's Geology, &c., of Sussex*, pp. 102, 183, t. 6, fig. 21.

— — *Morris.* 1854. *Cat. of Brit. Foss.*, 2d edit., p. 270.

P. testá elongatá, fusiformi, spiraliter lineatá; spirá conicá, acuminatá: anfractibus convexiusculis, postice sub-concavis, marginatis, ad suturam leviter crenulatis; ultimo anfractu in canali longo, angusto, subrecto exeunti; striis spiralibus numerosis, lineis incrementi decussatis, alternis vel trinis crassis, cæteris tenuibus: aperturá ovatá; labro arcuato, sinu profundo, sub-trigono, in margine collocato.

Shell fusiform, elongated, ornamented with spiral, raised lines: spire elevated, conical, pointed: whorls convex, thickened on the margin, where they present a raised border running round the suture, feebly crenulated at the edge, and traversed by two or three slender, concentric, raised lines; the space between the suture and the shoulder slightly concave, and covered with very fine, thread-like, concentric, raised lines, which are crowded near the raised border: the last whorl terminates in an elongated, nearly straight canal, almost as long as the spire. The spiral lines on the middle and front parts of the whorls are numerous, strongly decussated by the lines of growth, and unequal; every alternate or third line being thick, prominent, and sharp on the edges, and the intermediate lines thread-like and slender. The aperture is ovate, the outer lip much arched, and the sinus, which is placed in the depression between the suture and the shoulder, is deep, moderately wide, and sub-trigonal in shape.

This species appears to be the analogue of the Barton and Highcliff species, *P. rostrata*, from which it is distinguished by the absence of the tubercles and the ribs, or undulations on the shoulders.

Size.—Axis, 2 inches and 2-12ths; diameter, rather more than 8-12ths of an inch.

Locality.—Bracklesham Bay.

No. 135. *PLEUROTOMA HELIX*, *F. E. Edwards*. Tab. XXV, fig. 7 *a, b*.

P. testá elongato-fusiformi, sub-turritá, fasciis spiralibus, lineis incrementi asperatis, cinctá; spirá elevatá: anfractibus convexis; marginibus posticis latis, cavatis, lineas concentricas filiformes inæquales gerentibus, ad suturam crenulatis; fasciis spiralibus angustis, numerosis, alternatim majoribus et minoribus: aperturá elongato-ovali, in canali longo terminanti; labro valde arcuato; sinu angusto, profundo, in margine collocato.

Var. RICNA. *Testá anfractibus sub-angulatis; fasciis spiralibus numerosioribus, tribus minoribus inter majores apparentibus.*

Shell lengthened, fusiform, and covered with concentric bands, roughened by the strongly marked lines of growth; spire elevated: whorls convex, rounded at the shoulder, produced in front; the posterior margins wide, channeled, and bordered round the suture by two or three bands strongly crenulated; the middle of the margin presents three coarse, rounded, raised lines, and on each side of these three or more fine thread-like lines. The line of the suture is very decurrent, and runs at some distance below the wide part of the whorl, giving a screw-like appearance to the spire. The spiral bands are numerous, rounded at the edges, and unequal, the alternate ones being smaller than the others. The aperture is of a narrow, ovate form, and terminates in a longish straight canal; the outer lip is much arched, and the sinus, which is deep and moderately wide, is placed in the middle of the margin.

Specimens occur at Potter's Bar (*var. ricna*), in which the shoulders of the whorls are angulated, and a fine thread-like line runs on each of the smaller spiral bands.

The specimens figured were obtained from the railway cutting at Primrose Hill, and form part of Mr. Wetherell's collection.

Size.—The exact dimensions cannot be given, but those of the largest specimen figured must have been—axis, nearly 3 inches; diameter, 11-12ths of an inch.

Localities.—Primrose Hill and Potter's Bar.

No. 136. *PLEUROTOMA SYMMETRICA*. *F. E. Edwards*. Tab. XXV, fig. 5 *a, b*.

P. testá elongato-fusiformi, gracili, spiraliter fasciatá, in juventá costulatá; spirá elevatá: anfractibus convexiusculis, marginibus posticis vix cavatis, ad suturam marginatis, crenulatis; ultimo anfractu in canali longo exeunti; fasciis spiralibus irregularibus, lineis incrementi asperatis: aperturá ovali elongatá; labro valde arcuato; sinu mediocriter lato, parum profundo, in margine collocato.

Shell lengthened, slender, fusiform, ornamented with numerous spiral bands, and, in the early stages of its growth, obscurely ribbed: spire elevated, pointed: whorls

(8—10) slightly convex; the posterior margins narrow, very slightly depressed, rather thickened at the edges, and presenting round the suture two raised lines, obscurely granulated; in front of these, two or three fine, thread-like lines run along the middle part of the margin, granulated by the lines of growth, which are much elevated until they cross the shoulder, and give a wrinkled appearance to the margin. The spiral bands over the other parts of the whorls are numerous, irregular, and unequal; smaller ones alternating with large ones. The aperture is narrow, and of an oblong-oval form; the outer lip arched, and the sinus, which is moderately wide, and not very deep, is placed in the front part of the margin, immediately behind the shoulder.

In the ornamentation the present species resembles *P. helix*, but the narrow posterior margin, the position of the sinus, and the slight but nearly regular convexity of the whorls, giving a symmetrical appearance to the shell, distinguishes it as well from that species as from *P. crassa*.

Size.—The largest specimen figured would be, if perfect—axis, nearly 4 inches; diameter, 1 inch.

Localities.—Potter's Bar, Chalk Farm, Southampton, Shenfield.

NO. 137. *PLEUROTOMA TERETRIUM*. *F. E. Edwards*. Tab. XXV, fig. 8 *a—h*.

P. testá elongatá, fusiformi, spiraliter lineatá: anfractibus convexiusculis, marginibus posticis concavis, concentricè lineatis, ad suturam marginatis; suturis perspicuis; ultimo anfractu valde producto, in canali longo exeunti; lineis spiralibus irregularibus, alternatim funiculosi et tenuibus, lineis incrementi per-asperatis; aperturá elongato-ovali; labro valde arcuato; sinu lato, profundo, in margine collocato.

Var. NANODIS. *Testá breviori, latiori; marginibus posticis anfractuum paucillum cavatis.*

Var. CREBRILINEA. *Testá minori, graciliori: anfractibus obsolete tuberculatis, lineis spiralibus numerosis, æqualibus, fortiter decussatis.*

Var. TUBERCLATA. *Testá graciliori: anfractibus sub-angulatis, tuberculatis, ad suturam crenulatis; lineis spiralibus confertis, sub-æqualibus.*

Var. LATIMARGINATA. *Testá minori: spirá tuberculatá: marginibus anfractuum latissimis, contrá spiram expressis.*

Shell elongate, fusiform, ornamented with numerous spiral, raised lines; spire elevated, formed of 7—9 volutions: whorls somewhat convex, separated by a perspicuous suture, and much produced in front, the last whorl terminating in a long, nearly straight canal; the posterior margins concave, slightly thickened, and occasionally feebly crenulated at the edge. The spiral lines over the middle and front parts of the whorls are irregular, thickish, cord-like bands, alternating with slender, thread-like lines, and

all much roughened, almost decussated, by the lines of growth; the spiral lines on the posterior margins are numerous and nearly equal, the two or three nearest the suture being rather more prominent than the others. The aperture is of a lengthened, ovate form; the outer lip much arched; and the sinus, which is placed in the front part of the marginal depression, is deep and moderately wide. Specimens frequently occur (var. *nanodis*, fig. 8 *b*) in which the shell is shorter and wider than in the typical form, and the margins of the whorls not being so much depressed and hollowed out, give a nearly conical form to the spire; but the character of the concentric lineation, the shape and position of the sinus, and the form of the outer lip, correspond with those of the type.

Other forms also occur which, although presenting differences in the proportions or ornamentation of the shells, or in the form of the outer lip, agree in other respects so closely with the present species, that they appear to me to be merely varieties of it.

In the first of these forms (var. *crebrilinea*, fig. 8 *f*), the shell is smaller and narrower, the spire more pointed and obscurely tuberculated; the spiral lines are slender, numerous, and deeply cut by the sharp, prominent lines of growth, and the margins of the whorls are finely plicated. In the next form (var. *tuberculata*, fig. 8 *c—e*) the spire is more slender; the concentric ornamentation resembles that of the variety *crebrilinea*, but the whorls are angulated, and present a single row of slightly oblique, oblong tubercles, which are continued, in some instances, even on the last whorl of the fully formed shell. The third variety (var. *latimarginata*, fig. 8 *g, h*) resembles the preceding variety in the proportions of the shell, and the angular and tuberculated whorls, but the posterior margins are widely spread out, and pressed against the preceding whorls, which are covered by them almost up to the tubercles. In all the last three varieties, the outer lip is not so much arched as that of the typical form.

This species so closely resembles one from Tortona (*P. granulosa*, Bon.; *P. Sismondæ*, Bell.), that it is difficult to separate the two. In the Italian shell, the whorls appear to be more numerous, and the posterior margins present from three to five rows of bead-like granulations near the suture; but, judging from the figure and description given by Bellardi, the two species appear to agree in the form of the whorls, the character of the spiral ornamentation, the condition of the outer lip, and the position and shape of the sinus. The differences pointed out are scarcely sufficient to justify the separation of the present species; but without an actual comparison of the shells themselves, I do not venture to identify a form from the older eocene deposits in this country with one from the pliocene formations of Italy.

Size.—Of the type; axis, 2 inches and a half; diameter, 10-12ths of an inch. Of the variety *tuberculata*; axis, 1 inch and 7-12ths; diameter, not quite half an inch.

Localities.—The species is found, in all its varieties, at Highgate; the variety *crebrilinea* also occurs at Potter's Bar and Shenfield; and the variety *tuberculata* at

Southampton, Shenfield, Clarendon Hill, Primrose Hill, Haverstock Hill, and Alum Bay (No. 4, Prestwich). In the variety *crebrilinea*, from Shenfield, the body-whorl is short, and rather suddenly contracted in front, and the lineation is very fine and nearly equal.

No. 138. *PLEUROTOMA CRASSA*. *F. E. Edwards*. Tab. XXVI, fig. 1 *a—d*.

P. testá elongato-fusiformi, longitudinaliter costulatá, spiraliter fasciatá; spirá elevatá, acuminatá: anfractibus convexis, antice subito coarctatis; marginibus posticis concavis, concentricè granuloso-lineatis, ad suturam incrassatis, oblique plicatis; suturis perspicuis; fasciis spiralibus numerosis, plus minusve latis, crassis, cum lineis concentricis filiformibus alternantibus, lineis incrementi per-asperatis: aperturá oblongo-ovali; labro leviter arcuato; sinu lato sub-triangulari in mediá margine collocato; canali antico, longo, recto.

Shell elongate, fusiform, longitudinally ribbed, and spirally banded: spire elevated, being nearly as long as half the shell, and pointed: whorls many (9—11), convex, rather suddenly contracted, and much produced in front; the posterior margins hollowed out, thickened and strongly plicated by the prominent lines of growth on the sutural edge; the ribs rounded, moderately distant, rather oblique and short, not extending, even in young shells, much in front of the shoulder, and lost on the last whorl of the fully grown shell. Several coarsish concentric lines traverse the margins of the whorls, and are decussated by the lines of growth; two or three on the sutural edges are thicker and more elevated than the others, and from the deep decussation assume the appearance of a double row of coarse granulations: the bands over the middle and front of the whorls are more or less broad, prominent, rather closely set, and separated by strong, thread-like lines, the whole much roughened by the lines of growth: the body whorl is produced in front into a long, moderately wide, and nearly straight canal. The aperture is of an oblong, ovate shape; the outer lip arched, but not much; and the sinus, which is placed in the middle of the margin, is wide and subtrigonal. Occasionally specimens occur in which the shell is wider, and the spire not so much produced; but in all other respects agreeing with the typical form.

Size.—The large specimen figured would be, if perfect—axis, 4 inches and 3·12ths; diameter, 1 inch and 4·12ths.

Localities.—Clarendon Hill, Southampton, Shenfield.

No. 139. *PLEUROTOMA PLANETICA*. *F. E. Edwards*. Tab. XXVI, fig. 3.

P. testá elongato-fusiformi, sub-turritá, undique spiraliter lineatá; spirá elevatá, acumi-

natá: anfractibus numerosis, angulatis, convexis, sub-ventricosis, in juventá tuberculatis; marginibus posticis latiusculis, concavis; ultimo anfractu in canali longo, recto, terminanti; striis spiralibus numerosis, inæqualibus, lineis incrementi asperatis; striis duobus vel tribus ad humeros prominentioribus: aperturá pyriformi; labro arcuato; sinu lato, profundo, in margine collocato.

Shell elongate, fusiform; spire much produced, pointed: whorls many (10—12), convex, somewhat ventricose, angulated at the shoulders, much attenuated, and produced in front, the last whorl terminating in a long, straight, moderately wide canal; the posterior margins are rather wide, depressed, channeled along the middle, and somewhat thickened at the edge, so as to present a broadish, slightly elevated border round the suture. The angulated shoulders, and depressed posterior margins of the whorls, give a turreted character to the spire. Two sharp, elevated, and rather distant spiral lines run round the border, and several faint and unequal lines traverse the hollow part of the margins. On the middle and front parts of the whorls the spiral lines are numerous, irregular, and unequal, a slender, thread-like line occasionally occurring between thicker and more elevated lines; two or three on the shoulder are more prominent and distant than the rest. The aperture is pear-shaped, rounded behind, contracted in front; the outer lip much arched; the sinus wide, very deep, sub-trigonal in form, and placed a little in front of the middle part of the margin.

This elegant *Pleurotoma* is apparently confined to the middle eocene strata; it has hitherto been obtained only from Bramshaw and the synchronous beds at Bracklesham Bay.

Size.—Axis, 2 inches and 9-12ths; diameter, 10-12ths of an inch.

No. 140. *PLEUROTOMA GONIÆA*, *F. E. Edwards*. Tab. XXV, fig. 10.

PLEUROTOMA TRANSVERSARIA, *Sow.* (non *Lam.*) 1850. *Dixon's Geol., &c., of Suss.*, p. 102.

— — — *Morris*. 1854. *Cat. Brit. Foss.*, 2d edit., p. 270.

P. testá elongato-fusiformi, turritá, lineis spiralibus omnino tectá; spirá elevatá: anfractibus depresso-convexis, angulatis, obscure carinatis; marginibus posticis latis, sub-concavis, ad suturam crenulatis; ultimo anfractu in canali mediocri, subrecto, exeunti; lineis spiralibus tenuibus, confertis, irregularibus: aperturá lanceolatá; labro rotundo-arcuato; sinu mediocriter lato, profundo, in margine collocato.

Shell elongated, fusiform, turreted; spire elevated, apparently much exceeding the last whorl in length: whorls rather convex, flattened at the sides, and angulated at the shoulders, which slightly project, and present the appearance of an obscure, rounded keel; the posterior margins are very wide, hollowed out, and crenulated round the suture; the last whorl contracts rather suddenly in front, and

terminates in a widish, moderately long, and nearly straight canal. The whole surface of the shell is covered with very fine, spiral, raised lines, rather distant in front, crowded, unequal, and irregular over the middle part of the whorls, where very slender, thread-like lines frequently alternate with thicker and more prominent lines; three or four faint lines run along the middle of the posterior margin, and on each side of them are several others, rather stronger and decussated by the lines of growth. The aperture is lanceolate; the outer lip large, and roundly arched; and the sinus deep, moderately wide, and placed in the very middle of the collar: the columella is slightly twisted.

The shell figured forms part of my collection, and is the specimen which Mr. Sowerby (loc. cit.) has referred to *P. transversaria* (Lam.); but the long, turreted spire, the angulated whorls, the character of the transverse lineation, the shape of the outer lip, and especially the position of the labial sinus, seem to entitle it to specific distinction. The species is very rare.

Size.—If the specimen figured were perfect, the dimensions would be—axis, 2 inches and 4-12ths nearly; diameter, 10-12ths of an inch.

Locality.—Bracklesham Bay.

No. 141. PLEUROTOMA TRANSVERSARIA, *Lamarck*. Tab. XXV, fig. 9 *a*, *b*.

PLEUROTOMA TRANSVERSARIA, <i>Lamk.</i> 1804. Ann. du Mus., vol. iii, p. 166, No. 6.		
—	—	<i>Ib.</i> 1822. Hist. Nat., vol. vii, p. 98, No. 1.
—	—	<i>De Blainv.</i> 1826. Dict. des sc. nat., vol. xli, p. 389.
—	—	<i>Desh.</i> 1832. Encyc. méthod. (Vers.), vol. iii, p. 796, No. 14.
—	—	<i>Ib.</i> 1824-37. Descr. des coq. foss., &c., vol. ii, p. 450, t. 62, figs. 1, 2.
Nec PLEUROTOMA TRANSVERSARIA, <i>Grat.</i> 1838. Tabl. stat. des. coq., &c., de l'Adour, p. 13, No. 152.		
nec	—	<i>Ib.</i> 1838. Cat. zool., &c., de la Gironde, p. 45, No. 382.
nec	—	<i>Ib.</i> 1847. Conchyl. foss., &c., de l'Adour, supp. Pleurot., t. 1, fig. 11, No. 19.
nec	—	<i>Sow.</i> 1850. Dixon's Geol., &c., of Sussex, p. 102.

P. testá elongato-fusiformi, spirá acuminatá: anfractibus convexiusculis, postice et antice tenuissime lineatis, cæterum levibus; marginibus posticis depressis, sub-canaliculatis; ultimo anfractu in canali longo, angusto, exeunti: aperturá ovatá; labro tenuissimo, arcuato; sinu mediocriter lato, profundo, in margine collocato.

Var. CYPHA (fig. 9 *b*). *Testá minori; anfractibus convexis; marginibus posticis depressioribus.*

Shell fusiform, elongated, with an elevated, nearly conical spire: whorls (10—11) slightly convex, and depressed, almost channeled, on the posterior margins; the space between the suture and the shoulder is covered with numerous, very fine, spiral,

raised lines, which, in well-preserved specimens, are decussated by the lines of growth; the middle part of the whorl in the adult shell is quite smooth, and the body-whorl, which is rather longer than the spire, terminates in a long, narrow, nearly straight canal, ornamented with numerous, somewhat irregular, obliquely transverse, raised lines; these lines, which are very fine and undulating, gradually become more and more feeble as they ascend the canal, and ultimately disappear towards the middle of the whorl. The aperture is ovately oblong; the right lip very thin, and much arched; the sinus, which is placed in the margin, just behind the shoulder, is wide and moderately deep.

In the specimens from Lyndhurst (var. *cypha*), the whorls are more convex, the posterior margins more depressed, and the outer lip less roundly arched than in the typical form, and the shells themselves are smaller; but in the ornamentation, and in the position and shape of the labial sinus, they agree with *P. transversaria*, of which they appear to be merely local varieties.

The shells from Dax and the environs of Bordeaux, described by Grateloup, and to which M. Deshayes refers as being possibly a variety of the Paris basin species, are specifically distinct, and have been named *P. opis* by M. D'Orbigny; and the specimen from Bracklesham Bay which Mr. Sowerby (Dixon's 'Geol.,' &c.) has referred to the present species, also appears to be specifically distinct, and I have separated it accordingly under the name *P. gonieæ*.

Our English specimens have attained a less size, and are somewhat narrower, than the French ones, but in all other respects they agree well.

Size.—Axis, 1 inch and 10-12ths; diameter, rather more than 7-12ths of an inch.

Localities.—Brockenhurst, Lyndhurst. *French*—Parnes, Grignon, Chaumont (fide D'Orb.); Marquemont, Lattainville, Hermes, Neuvilleboise, Saint-Felix (fide Graves); Betz, department de l'Oise (fide De Blain.)

NO. 142. PLEUROTOMA CYMÆA, F. E. Edwards. Tab. XXVI, fig. 4 *a*, *b*. Tab. XXVII, fig. 9.

P. testá elongato-fusiformi, latiusculá, tuberculatá, undique spiraliter lineatá; spirá elevatá, sub-conicá; anfractibus convexis, angulatis; marginibus posticis latis, vix cavatis; tuberculis numerosis, parvis, nodiformibus, obliquis; lineis spiralibus confertis, subtilissimis, undulosis, antice eminentioribus, postice fere obsoletis: aperturá oblongo-ovali, in canali longo, recto, exeunti; labro arcuato, tenui; sinu profundo, in margine collocato.

Var. NANA. Testá minori, angustiori; canali longiori?

Shell rather broad, fusiform, with an elevated, nearly conical spire, formed of nine or ten volutions: whorls convex, sharply angulated at the shoulders, where they present

a row of numerous, obliquely compressed, small, knob-like tubercles. The whole surface of the whorls is covered with very fine, slightly undulating, closely set, thread-like, concentric raised lines, irregular, unequal, and roughened by the lines of growth; these lines are prominent on the canal and the front part of the shell, but become more and more faint, and at last are almost effaced as they approach the shoulders of the whorls. The posterior margins are wide, very slightly channeled along the middle, and ornamented with numerous slender, concentric lines, four or five of which, running along the sutural edge, are more prominent than the rest, and are decussated by the oblique lines of growth of the sinus, forming a riband-like border to the whorls. The aperture is of an oblong, oval form, and terminates in front in a long, straight canal; the outer lip is thin, sharp-edged, and much arched; the sinus is deep, not very wide, and placed a little in front of the middle of the collar.

In the variety *nana* (Tab. XXVII, fig. 9), which is proposed for an immature specimen from Colwell Bay, in my collection, the shell is much smaller and narrower, and, apparently, the canal is more produced; but on this last point I cannot speak with certainty, as the canal is not perfect in any of the specimens of the type I have seen. In the general form of the shell, however, in the nearly conical spire, the character of the ornamentation, the position and shape of the sinus, and the roundedly arched outer lip, the specimen in question agrees so exactly with the true *P. cymæa*, that I can only regard it as a variety of that species dwarfed by unfavorable conditions.

This *Pleurotoma*, which at first sight might be considered to be a local variety of *P. dentata*, is distinguishable from that species by the greater width of the shell, the more conical spire, the wider posterior margins of the whorls, the character of the transverse ornamentation, and the numerous small, knob-like tubercles which take the place of the sharp-edged transverse teeth, characteristic of *P. dentata*. It more resembles *P. transversaria*, as well in the shape and relative proportions of the shell, as in the form and position of the sinus and the character of the concentric lineation; and a larger series of specimens may eventually lead to the conclusion that it is merely a variety of that species. The tuberculated and sharply angulated whorls, however, characters to which I am not aware that *P. transversaria* offers any approach, apparently entitle the shells in question to specific distinction.

Size.—Axis, 1 inch and 4-12ths; diameter, $\frac{1}{2}$ inch

Locality.—Brockenhurst and Colwell Bay, at each of which places it appears to be very rare.

No. 143. *PLEUROTOMA COCCIPHORA*, *F. E. Edwards*. Tab. XXVI, fig. 2.

P. testá elongatá, fusiformi, longitudinaliter costellatá, undique spiraliter granuloso-lineatis anfractibus convexiusculis, angulatis, ad suturas incrassatis, granulatis; marginibus posticis mediocriter latis, vix cavatis, lineas filiformes confertas gerentibus; costellis angustis; lineis spiralibus numerosis, fortiter decussatis, inæqualibus, lineis majoribus cum lineis tenuibus alternantibus; aperturá ovali; labro leviter arcuato; sinu fere semicirculari, in margine collocato.

Shell elongate, fusiform, longitudinally ribbed, and having the whole surface ornamented with spiral raised lines; spire elevated, pointed: whorls (7—9) slightly convex, angulated; the posterior margins moderately wide, nearly straight, and covered with fine, thread-like, concentric lines; two on the sutural edge are more prominent than the others, and decussated by the lines of growth so as to present a double row of fine granulations; the last whorl is produced in front into a long, and apparently nearly straight, and moderately wide canal; the costellæ are narrow, rather short, barely extending beyond the middle of the whorl, and are more or less distant in different specimens; the spiral lines over the middle and front parts of the shells are numerous and unequal, a slender, thread-like line occasionally intervening between others thicker and more prominent; all are deeply and regularly decussated by the lines of growth, so that the larger lines assume the appearance of rows of bead-like knobs. The aperture is of an oblong, oval shape; the outer lip slightly arched; and the sinus, which is placed towards the front of the margin, is wide, not very deep, and almost semicircular.

This *Pleurotoma* closely resembles the young shell of *P. crassa*, of which, if it were not for the great difference in size, it might be considered to be only a local variety; the spire, however, is shorter and more conical, the whorls more angulated, less convex and more gradually attenuated in front; the posterior margins narrower and less concave; and the sinus nearer the shoulder, and rounder than in that species. The spiral lines also, broken into rows of beads by the lines of growth, form an ornamentation quite distinct in character from the broad, coarse bands which characterise *P. crassa*.

The specimen figured forms part of Mr. Wetherell's collection.

Size.—Axis, rather more than 1 inch; diameter, 4-12ths of an inch.

Locality.—Highgate, where it is apparently very rare.

No. 144. PLEUROTOMA ROSTRATA, *Solander*. Tab XXVI, fig. 8 *a—c*.

- MUREX ROSTRATUS, *Sol.* 1766. *Brand.*, Foss. Hanton., p. 21, t. 2, fig. 24.
 PLEUROTOMA ROSTRATA, *Sow.* 1818. *Min. Con.*, vol. ii, p. 104, t. 146, fig. 3.
 — — — *De Bl.* 1826. *Dict. des. sci. nat.*, vol. xli, p. 390.
 — — — *Morris.* 1842. *Cat. Brit. Foss.*, p. 157.
 — SUB-ROSTRATA, *D'Orb.* 1850. *Prod. de Paléont.*, vol. ii, p. 359, No. 406.
 — ROSTRATA? *Phil.* 1851. *Tert. Foss. Magdeb.* (*Palæont.*, vol. i, p. 64), No. 118.
 — — — *Morris.* 1854. *Cat. Brit. Foss.*, 2d edit., p. 270.
 Nec PLEUROTOMA ROSTRATA, *De Kon.* 1837. *Desc. des. coq. foss.*, &c., de Basele, Boom, &c.,
 p. 24, No. 23.
 nec — — — *Nyst.* 1843. *Desc. des. coq. foss.*, &c., de la Belg., p. 522, t. 42,
 figs. 2, 3.
 nec — — — *Ib.* 1843. *Bull. Soc. Géol. de France*, vol. xiv, p. 453.

P. testá elongato-fusiformi, angustá, turritá, undique spiraliter lineatá; spirá elevatá, acuminatá: anfractibus numerosis, convexis, in medio oblique tuberculatis; marginibus posticis concavis, ad suturam aliquando paulum incrassatis et cingulo duplici crenulato cinctis, aliquando simplicibus; lineis spiralibus in margine tenuibus, cæteris elevatis, rotundatis, irregularibus, inæqualibus, lineis incrementi per-asperatis: aperturá oblongo-ovali, in canali prælongo, angustato, subrecto productá; labro aliformi; sinu profundo mediocriter lato, in margine collocato.

Var. ANTIQUA. Testá latiori, breviori; anfractibus subangulatis.

Shell long, narrow, fusiform, turreted, having the whole surface covered with spiral raised lines; the spire much elevated, being nearly half the length of the whole shell, and pointed; the whorls are numerous (10—12 without the pullus), very convex, and armed near the middle with a single row of oblique tubercles, more or less prominent in different individuals; the posterior margins are moderately wide, concave, occasionally thin, and nearly smooth along the sutural edge, but more frequently slightly thickened, plicated, and ornamented with two prominent concentric lines, granulated by the lines of growth. The spiral lines in the middle of the posterior margin are close-set and very slender; over the other parts of the whorl they are prominent, rounded, irregular, unequal, small filiform lines intervening between larger ones; and all are very much roughened, almost granulated, by the lines of growth. The aperture is of an oblong, ovate form, and terminates in front in a long, rather narrow, and somewhat curved canal; the outer lip is roundedly arched and wing-like; the sinus is deep, moderately wide, subtrigonal, and placed in the middle of the margin.

In the specimens from Highcliff (*var. antiqua*, fig. 8 *c*), the shells are wider, and

proportionately shorter than in the type, and the whorls are slightly angulated at the shoulders.

Much confusion exists among several of the Continental authors with respect to this species, in consequence of the shell figured as *P. rostrata* in 'Mineral Conchology' having been considered by them as distinct from the *Murex rostratus* of Solander, although Mr. Sowerby cites the latter as a synonym. Thus M. de Koninck has described a pleurotoma from Basele and Boom, which he has referred to *P. rostrata* of Sowerby, but without having cited Brander's figure; and this pleurotoma, Nyst, after stating that it differs essentially from *Murex rostratus*, but that it is without doubt Sowerby's *P. rostrata*, regards as merely a variety of *P. Selysii* (De Kon.), to which latter species he refers it. The same author subsequently describes another species, from Basele, Boom, &c., as identical with Brander's shell, but he excludes *P. rostrata* of Sowerby. The description given by M. de Koninck agrees tolerably well with the present species; but, assuming that the shells described by that author belong, in fact, to the same species as those represented by Nyst (*P. Selysii*, t. 40, fig. 11 and *P. rostrata*, t. 42, figs. 2, 3), I do not think that any one familiar with the English shells can regard either of them as identical with the species figured by Brander, and described by Sowerby. Philippi has recorded a single specimen from Görzig, in the Museum at Halle, which he has referred to the present species. This author, however, has not given either figure or description, and as, under the circumstances to which I have referred, the accuracy of this identification cannot be assumed, I have cited Philippi with a query. At present there appears to be every reason for believing that the true *P. rostrata* of Solander is confined to the upper beds of the middle eocene formations of England; and, although Mr. Morris gives Highgate and Sheppey as localities, I am not aware of its occurrence at either of those places, nor even at Bracklesham Bay, which is also given as a locality by the same author.

Size.—Axis, rather more than $4\frac{1}{2}$ inches; diameter, not quite 1 inch.

Localities.—Barton, Alum Bay (No. 29, Prestwich), and Highcliff.

No. 145. *PLEUROTOMA KEELEI*, *F. E. Edwards*. Tab. XXVI, fig. 6.

P. testâ fusiformi, turratâ, tuberculatâ spiraliter fasciatâ; spirâ elevatâ, acuminatâ: anfractibus convexis, ad humeros angulatis, unâ serie tuberculorum spiniformium munitis; marginibus posticis latis, concavis, concentrice lineatis, ad suturas crenulatis; ultimo anfractu turbinato, in canali longo exeunti; fasciis spiralibus, irregularibus, inæqualibus, fasciis crassis cum aliis tenuibus alternantibus: aperturâ oblongo-ovali; labro valde arcuato, sinu mediocriter lato profundo, in margine collocato.

Shell fusiform, turreted, tuberculated, spirally banded; the spire much elevated,

pointed, formed of nine or ten volutions : whorls angulated at the shoulders, and armed with a single row of large, pointed, rather distant tubercles ; the posterior margins wide, concave, thickened and obliquely plicated at the suture, and ornamented with several fine concentric raised lines ; of these, two running round the border are more elevated than the rest, and are decussated and feebly granulated by the plication on the edge, and two others, running along the hollow part of the margin, are also rather prominent and granulated by the lines of growth. The last whorl is somewhat turbinate, and terminates in front in a long, moderately wide, straight canal. The bands on the middle and front surfaces of the whorls are numerous, coarse, irregular, and very unequal, and much roughened by the lines of growth ; three or four over the middle part of the whorls are thicker and more prominent than the rest, and between them appear two or three smaller unequal bands. The aperture is of an oblong, ovate form ; the outer lip much arched ; the sinus deep, moderately wide, sub-trigonal, and placed in the very middle of the margin.

This beautiful and well-marked species was first obtained from the Artesian well at Southampton, by Mr. Keele, to whom I have ventured to dedicate it.

Size.—Axis, 3 inches and 3-12ths ; diameter, 1 inch and 1-12th.

Localities.—Southampton and Shenfield.

No. 146. PLEUROTOMA DENTATA, *Lamarck*. Tab. XXVI, fig. 5.

PLEUROTOMA DENTATA, *Lamk.* 1804. Ann. du Mus., vol. iii, p. 167, No. 8 ; vol. vii, t. 13, fig. 1.

— — *Ib.* 1822. Hist. nat., vol. vii, p. 99, No. 13.

— — *De Bl.* 1826. Dict. des sci. nat., vol. xli, p. 395.

— COSTULIFERA ? *Bronn.* 1827. Zeitschrift für Mineral., band ii, p. 535, No. 120.

— DENTATA, *Ib.* 1831. Italiens tertiärgeb., p. 46, No. 222.

— — *Desh.* 1832. Enc. méth. (Vers), vol. iii, p. 797, t. 440, fig. 8, No. 16.

— — *Ib.* 1824-37. Descr. des coq. foss., &c., vol. ii, p. 452, t. 62, figs. 3, 4, 7, 8.

— — *Morris.* 1843. Cat. Brit. Foss., p. 157.

— — *Sow.* 1850. Dixon's Geol., &c., of Sussex, p. 102, t. 6, fig. 24.

— — *Rouault.* 1848. Desc. des foss., &c., de Pau (Mém. de la Soc. Géol. de France, 2d series, vol. iii, p. 484), No. 92, t. 16, fig. 24.

— — *D'Orb.* 1853. Prod. de Paléont., vol. ii, p. 358, No. 382.

— — *Morris.* 1854. Cat. Brit. Foss., 2d edit., p. 270.

P. testá elongatá, fusiformi, undique concentrice lineatá ; spirá elevatá, acuminatá : anfractibus convexiusculis, angulatis, dentato-tuberculatis ; marginibus posticis mediocriter latis, vix cavatis, ad suturas paucillum incrassatis ; ultimo anfractu in canali longo termi-

nanti; striis concentricis confertis, irregularibus, in marginibus posticis tenuissimis; cæteris, striis eminentioribus cum aliis tenuibus alternantibus: aperturâ angusto-ovali; labro arcuato, tenui; sinu lato, sub-trigono, in margine collocato; canali subrecto, antice reflexo, emarginato.

Shell elongated, fusiform, having the whole surface ornamented with concentric raised lines; the spire much elevated, being nearly as long as the body-whorl, pointed, and formed of ten or eleven volutions. The whorls are rather convex, sharply angulated at the shoulders, and armed with a row of transversely compressed, tooth-like tubercles, rounded in front, sharp, sometimes almost carinated at the edges, varying both in number and prominence in different individuals, and occasionally having their bases prolonged into short, rounded costellæ; the posterior margins are moderately wide, straight, or but very slightly hollowed out, and a little thickened at the sutural edges, where they are sometimes obliquely plicated by the lines of growth of the sinus; the surface between the suture and the shoulder is covered with very fine, almost obsolete, concentric lines, two of which, running round the sutural edge, are more elevated than the rest; the middle and front parts of the whorls are ornamented with numerous, irregular, undulating, thread-like, raised lines; of these some are prominent, and between them appear two or three others very slender, so much so, in fact, as to be barely perceptible by the naked eye. The aperture is of a narrow, ovate form, and terminates in a long, moderately wide, and nearly straight canal, bent backwards, and notched at the anterior extremity; the outer lip is thin, sharp-edged, and slightly arched; the sinus wide, rather deep, sub-trigonal in form, and placed in the very middle of the margin; the anterior extremity of the columella presents a prominent ridge or crest, formed by the notch of the canal.

This species is very common and widely distributed in the French formations; in England it is, apparently, confined to the middle beds of the Bracklesham Bay series. Our specimens are narrower than the French type; and in this respect and in the character of the transverse ornamentation they agree with the variety *a* of Deshayes; I have not met with the other variety recorded by that author, nor do our shells appear to have attained the size of those from the French beds. D'Orbigny, (loc. cit.) gives Claiborne, in Alabama (U.S.), as a locality. I cannot but think, however, that this identification is somewhat questionable. The present species is the type of a group of closely analogous forms, and two English species (*P. exorta* and *P. macilenta*, Sol.), which, as will be afterwards shown, are perfectly distinct, have in fact been confounded with it. No authority is cited by the author, and I have therefore given Claiborne as a questionable locality.

Size.—Axis, 1 inch and 7-12ths (40 millim.); diameter, not quite 7-12ths of an inch (15 millim., nearly).

Localities.—Bracklesham Bay; Bramshaw. *French*—Grignon, Parnes, Mouchy, Courtagnon, &c., La Chapelle près Senlis, Valmondois (fide *Desh.*), Cuise-Lamotte,

Acy-en-Mulcien, Fosse-Martin, Ermenonville, Ver (fide *Graves*), Laon (fide *Mellev.*), Bos d'Arros (fide *Rouault*). *North American* — Claiborne, Alabama (fide *d'Orb.*)?

No. 147. *PLEUROTOMA TEXTILIOSA*, *Deshayes*. Tab. XXVI, fig. 7.

PLEUROTOMA TEXTILIOSA, *Desh.* 1824-37. Desc. des coq. foss., &c., vol. ii, p. 454, t. 62, figs. 5, 6.

— — *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 417, No. 1480.

P. testá elongato-fusiformi, angustá, sub-turritá, longitudinaliter costatá, spiraliter subtilissime lineatá; spirá elevatá, acuminatá: anfractibus sub-convexis, angulatis; marginibus posticis angustis, concavis, ad suturam inerassatis; costis distantibus, obtusis; lineis spiralibus confertis, inæqualibus, lineis incrementi sub-decussatis: aperturá ovato-angustá, in canali mediocri exeunti; labro acuto; sinu lato, trigono, in margine collocato.

Shell elongate, fusiform, narrow, longitudinally ribbed and ornamented with numerous, very fine, concentric, raised lines; the spire, which is formed of eight or nine volutions exclusive of the pullus, is pointed and much produced, fully equalling the last whorl in length: the whorls are slightly convex, and angulated at the shoulders; the posterior margins narrow, hollowed out, and thickened at the edges so as to form an elevated border round the suture; the whole of the margin is covered with very fine, regular, closely set, concentric lines, of which those on the border are more conspicuous than the rest. The longitudinal ribs are rather distant, round, thick, and short, barely extending to the middle of the whorls, and terminating abruptly at the shoulders, where they present a sharp keel-like edge, which gives somewhat of a turreted aspect to the spire. The concentric lines over the front and middle parts of the whorls are very numerous, unequal, and irregular; some of them, slender and thread-like, are prominent and more or less distant, and the intermediate spaces are covered with exceedingly fine lines, scarcely perceptible by the naked eye; the whole are roughened by the lines of growth. The aperture is of a narrow, ovate form, and terminates in front in a moderately long canal, slightly notched at the anterior extremity; the outer lip is thin, sharp-edged, and expanded behind; the sinus which is wide, deep, and somewhat trigonal in form, is placed a little in front of the middle part of the posterior margin of the whorl; the columella is slightly twisted and presents a conspicuous but not very prominent crest. M. Deshayes states that the columella is "sub-perforated at the base," presenting there a narrow, shallow "umbilical opening, partly covered by the inner lip;" this opening, however, is not truly umbilical, but a slight hollow caused by the ridge or crest being imperfectly overlapped by the inner lip, and is a character very variable, and sometimes wanting.

The present species is an intermediate form between *P. crassicosta* and *P. dentata*; but the thick, rounded, distant ribs, the crowded transverse ornamentation, and the broader and shorter canal, render it easily distinguishable.

Size.—Axis, 1 inch and 5-12ths nearly (35 millem.); diameter, half an inch (13 millem.). The French shells attained a somewhat larger size.

Localities.—Bracklesham Bay; Bramshaw. *French*—Monneville (fide *Desh.*), Aumont, Acy-en-Mulcien (fide *D'Orb.*). It is very rare in England, but, apparently, common in the French beds.

No. 148. *PLEUROTOMA EXORTA*, *Solander*. Tab. XXVI, fig. 12 *a*, *b*.

MUREX EXORTUS, *Sol.* 1766. *Brand.*, *Foss. Hanton.*, p. 20, fig. 32.

PLEUROTOMA EXORTA, *Sow.* 1816. *Min. Conchol.*, vol. ii, p. 104, t. 146, fig. 2.

— — *Morris.* 1843. *Cat. Brit. Foss.*, p. 157.

— — *Sow.* 1850. *Dixon's Geol., &c., of Sussex*, p. 102.

— — *D'Orb.* 1850. *Prod. de Paléont.*, vol. ii, p. 359, No. 408.

Nec PLEUROTOMA EXORTA, *Nyst.* 1835. *Recher. sur les coq. foss., &c., d'Anvers*, p. 28, No. 27.

nec — — *De Kon.* 1837. *Descr. des coq. foss., &c., de Basele, Boom, &c.*, p. 22, No. 21.

nec — — *D'Orb.* 1850. *Prod. de Paléont.*, vol. iii, p. 13, No. 195 m.

P. testá elongato-fusiformi, turritá, undique spiraliter lineatá: spirá elevatá, sub-conicá, nodulosá; anfractibus convexis, prioribus obscure costellatis; ultimo anfractu sub-conico scilicet sensim attenuato, in canali longiusculo exeunti; marginibus posticis declivis, cavatis, ad suturam incrassatis, transversim exilissime lineatis; striis spiralibus nonnullis remotiusculis, eminentioribus, acutis; ceteris subtilissimis æqualibus: aperturá lanceolatá; labro valde arcuato, tenui; sinu lato, in margine collocato.

Shell elongated, fusiform, turreted, ornamented with spiral raised lines; the spire elevated and terminating in a small pointed pullus formed of two or three smooth volutions: whorls convex, the earlier ones very broadly and obscurely ribbed, giving a nodulous aspect to the spire; the posterior margins are somewhat thickened on the sutural edge, and but slightly depressed, so that the spire presents a nearly conical form; the space between the suture and the shoulder is channeled and covered with very fine and regular concentric lines, so slender as scarcely to be visible by the naked eye or to detract from the smoothness of the surface. On the middle and front parts of the whorls, some of the spiral lines, rather distant from each other, are sharp and elevated; the rest, which cover the intermediate spaces, are very fine, close-set, and regular, although somewhat unequally prominent. The aperture is lanceolate, and terminates in a moderately long canal, gradually diminishing in width, and thus

assuming the sub-conical form described by Solander as the chief distinction between *P. exorta* and *P. macilenta*. The outer lip is thin and much arched; and the sinus, which is wide and sub-trigonal, is placed in the very middle of the margin.

The elevated transverse line on the shoulders of the whorls, broken by the undulations caused by the ribs, occasionally presents a resemblance to the denticulation characteristic of *P. dentata*; and this circumstance probably led to *P. exorta* being considered as identical with *P. dentata*. The two species are, however, distinct; in this the shell is wider and shorter, the spire thicker and more conical, the whorls not so much angulated, the posterior margins narrower and less depressed, and the anterior canal shorter and more conical.

Nyst, in his 'Recherches sur les coquilles fossiles de la province d'Anvers,' has recorded certain shells from Boom which he has referred to the present species, and for which he has given Sowerby's diagnosis verbatim. Subsequently, De Koninck, in his 'Coquilles fossiles de Basele, Boom, &c.,' described some shells from those localities under the name *P. regularis*, and other shells he referred to the present species. These different shells, Nyst, in his later work, 'Description des coquilles, &c., de la Belgique,' considered to be merely individuals of the same species in different stages of growth, and that author referred them, erroneously as I have already shown, to *P. rostrata* (Sol.) Unfortunately I have not any specimens of the Belgian species to refer to; but, assuming that De Koninck's *P. exorta* is but the young shell of his *P. regularis*, and judging from the figures given by him of the latter species and from those given by Nyst of the so-called *P. rostrata*, it is impossible to accept the identification of the Belgian shells with the present species as correct; a conclusion at which D'Orbigny has apparently also arrived, as that author has placed *P. rostrata* (Nyst) and *P. regularis* (De Kon.) in his "26th étage," under the specific name *P. exorta* (Nyst), in forgetfulness, probably, of that name having been previously used by Solander.

Size.—Axis, 1 inch and 1-12th; diameter, 5-12ths of an inch.

Localities.—Barton, Alum Bay (No. 29, Prestwich), Highcliff, Bracklesham Bay.

No. 149. *PLEUROTOMA MACILENTA*, Solander. Tab. XXVI, fig. 13 *a, b*.

MUREX MACILENTUS, Sol. 1766. Brand., Foss. Hanton., p. 30, fig. 33.

P. testá elongato-fusiformi, angustá, turritá, undique spiraliter lineatá, longitudinaliter costatá: spirá elevatá, acuminatá: anfractibus convexiusculis, angulatis; marginibus posticis concavis, ad suturam paulum incrassatis, transversim subtilissime lineatis; lineis spiralibus numerosis, inæqualibus, quibusdam filiformibus prætenuibus, inter alias eminentiores, acutas apparentibus; costis numerosis, angustis, obliquis, fere ad caudam tendentibus: aperturá

oblongo-ovali, in canali longo, angusto exeunti; labro leviter arcuato; sinu lato, in margine collocato.

Shell long, narrow, fusiform, turreted, longitudinally ribbed, and concentrically lined: the spire, consisting of nine or ten volutions, is pointed, elevated, forming nearly a half of the length of the whole shell. The whorls are slightly convex and angulated at the shoulders; the posterior margins concave, slightly thickened round the suture, and covered with fine, thread-like, concentric lines, one or two of which near the edge are stronger and more prominent than the rest. The spiral lines over the middle and front parts of the whorls are numerous, irregular, unequal; some, more or less distant from each other, are prominent and sharp, and the intermediate spaces are occupied by two or three, occasionally by four, very slender and regular lines; the longitudinal ribs, which are rather numerous, narrow, and oblique, reach almost to the anterior canal. The aperture is oblong and ovate, and terminates in a moderately long, straight, and narrow canal; the outer lip is thin and slightly arched; the sinus wide, semi-circular in shape, and placed in the middle of the margin.

The present species, distinguished by its long costated spire, appears to be peculiar to the English middle eocene strata; DeFrance, it is true, refers to it, although with doubt, as a synonym of *P. dentata*, but a slight comparison of the shells will prevent the two species being confounded. It presents closer resemblances as well to *P. textiliosa*, as to *P. crassi-costa*; from both of these species, however, notwithstanding the similarity in the ornamentation, it may be easily distinguished by the slenderer and more numerous ribs, and the longer and narrower anterior canal.

Size.—The dimensions of my largest specimen are—axis, 1 inch and 4-12ths; diameter, 5-12ths of an inch. Those of Brander's specimen, although represented in the figure given by him as considerably larger, are, in fact, very nearly the same.

Localities.—Barton, Alum Bay (No. 29, Prestwich), Highcliff, Bracklesham Bay.

NO. 150. *PLEUROTOMA CRASSI-COSTA*, F. E. Edwards. Tab. XXVI, fig. 10 *a, b*.

P. testá elongato-fusiformi, angustá, turrítá, costatá, undique spiraliter lineatá; spirá elevatá; anfractibus convexiusculis, angustatis; marginibus posticis latiusculis, concavis, tenuissime lineatis, ad suturam incrassatis, cingulo duplici ornatis; ultimo anfractu parvo, repente coarctato, in canali lato, longo, subrecto exeunti; costis distantibus, brevibus, crassis: lineis spiralibus confertis, inæqualibus, nonnullis eminentioribus fortibus, cæteris exilibus: aperturá oblongo-ovatá; labro leviter arcuato; sinu lato, fere semicirculari, in margine collocato.

Shell long, narrow, fusiform, turreted, ribbed, and having the whole surface ornamented with concentric lines: the spire, formed of eight or nine volutions exclusive of the pullus, is moderately elevated and pointed; whorls slightly convex, sharply angu-

lated at the shoulder; the posterior margins rather wide, hollowed out, and thickened on the sutural edge, which is bordered by two or three prominent, raised lines; the remaining surface of the margin is covered with very fine, close-set, concentric lines; the last whorl is small, and terminates in a wide and long canal, a little curved near the anterior extremity. The ribs are distant, rounded, short, not extending to the middle of the whorl, prolonged over the posterior margins almost to the suture, and bearing at the shoulders of the whorls a row of transverse tooth-shaped tubercles. The spiral lines over the middle and front parts of the whorls are numerous and unequal; some, at nearly regular and not very distant intervals, are rather thick and prominent, and between these appear two or three slender, thread-like lines. The aperture is ovate, the outer lip moderately arched, and the sinus, which is placed in the middle of the margin, is wide but not deep.

The *P. crassi-costa* bears a close resemblance to *P. dentata*, of which, perhaps, it may prove to be merely a local variety. It presents, however, certain peculiarities of form which appear to me sufficient to justify the separation. Thus the shell is narrower, the spire relatively more produced; the posterior margins of the whorls are not so wide, the whorls themselves smaller and more suddenly contracted in front, and the longitudinal ribs thicker and more distant. From *P. textiliosa* it is distinguishable by the character of the transverse ornamentation, and the thick, rounded, and more distant ribs of that species. It approaches very nearly to a species from the sables moyens, at Senlis, at present unpublished, but which M. Deshayes purposes to describe under the name *P. Michelini*, in his forthcoming appendix; without a comparison, however, with a better series of specimens of that species than I possess, I do not venture to pronounce on the identity. Should the English and French shells prove, eventually, to belong to the same species, the name proposed by M. Deshayes will be entitled to priority.

Size.—Axis, $1\frac{1}{2}$ inch; diameter, not quite half an inch.

Locality.—Bramshaw.

NO. 151. *PLEUROTOMA LANCEOLATA*, F. E. Edwards. Tab. XXVI, fig. 11 a, b.

P. testá elongatá, angustá, fusiformi, spiraliter lineatá: spirá elevatá, sub-conicá, tuberculatá: anfractibus convexiusculis; marginibus posticis mediocriter latis, pauxillum declivis, vix cavatis, transversim exilissime lineatis; ultimo anfractu antice gradatim attenuato, in canali longo exeunti: aperturá lanceolatá; labro valde arcuato; sinu lato sub-trigono, in margine collocato.

Shell long, very narrow, fusiform, ornamented with spiral, raised lines: the spire elevated, nearly conical, and terminating in a small, smooth, pointed pullus of two volutions: the whorls, 9—11 in number, are but slightly convex, and in the young

state are tuberculated, or roundedly costellated; the posterior margins are moderately wide, very little depressed, nearly straight, and almost smooth, or ornamented with concentric lines, so faint and slender as to be almost imperceptible without the aid of a magnifying glass; the last whorl is produced in front, and, diminishing very gradually, terminates in a long, nearly straight canal. The aperture is lanceolate; the outer lip thin, sharp edged, and much arched; and the sinus, which is very wide, and sub-trigonal in shape, is placed a little in front of the middle part of the margin.

The long, narrow, lanceolate form, and nearly conical spire of this *Pleurotoma* distinguish it from all its congeners.

Size.—Axis, 1 inch and 4-12ths; diameter, 4-12ths of an inch.

Localities.—Barton and Alum Bay (No. 29, Prestwich), where it is not very common.

No. 152. *PLEUROTOMA LÆVIGATA*, Sowerby. Tab. XXVI, fig. 9 *a*, *b*.

PLEUROTOMA LÆVIGATA, Sow. 1823. Min. Con., vol. iv, p. 120, t. 387, fig. 3.

— — — *Morris*. 1843. Cat. Brit. Foss., p. 157.

— — — *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 359, No. 412.

Nec *PLEUROTOMA LÆVIGATUM*, *Phil.* 1836. Enum. Moll. Sic., vol. i, p. 199, t. 11, fig. 17.

nec — — *LÆVIGATA*, *De Kon.* 1837. Coq. foss. de Basele, &c., p. 27, No. 27, t. 1, fig. 5.

nec — — — *Mellew.* 1843. Mém. sur les sables infér., &c., de Paris, p. 63, t. 8, figs. 9—11.

P. testá elongato-fusiformi, angustá, turrítá, transversim tenuissime lineatá: spirá elevatá, acuminatá: anfractibus convexis, antice subito coarctatis, prioribus oblique costellatis; marginibus posticis angustis, depressis, sub-canaliculatis, lævibus; ultimo anfractu in canali longo, angusto, terminanti: aperturá oblongá, ovatá; labro valde arcuato, tenui; sinu lato, fere semicirculari, in margine collocato.

Shell long, narrow, fusiform, turreted, costellated, and spirally lined: the spire elevated, pointed, terminating in a pullus of two round, smooth volutions; whorls convex, rounded on the shoulders, contracted rather suddenly in front; the posterior margins narrow, depressed, slightly hollowed out, having the sutural edges thin and quite simple, and the surface smooth, almost polished, presenting only very feeble lines of growth of the sinus. The ribs are distant, rounded, oblique, and extend almost to the front part of the whorl in the young shell, but become shorter and less prominent as the shell enlarges, and altogether disappear on the body-whorl of the fully formed shell; the spiral lines are very slender, sharp, but little elevated, irregular, unequal, and decussated by the lines of growth. The aperture is of an oblong, ovate form, and terminates in front in a long, narrow, and slightly curved canal; the outer lip is much

arched, and the sinus, which is wide and almost semicircular in shape, occupies the whole width of the margin.

Specimens occasionally occur in which the transverse lineation is nearly obliterated, and the whorls present a smooth, almost a polished, surface. The individuals figured by Mr. Sowerby were apparently in this condition; this smoothness, from which the specific name was taken, is, however, only an exceptional character.

The present species presents some analogy with *P. macilenta*; but the shell is narrower, the whorls more convex, more rounded on the shoulder, and more contracted in front; the canal is narrower, the outer lip more arched, and the sinus wider.

Size.—Axis, 1 inch and 3-12ths; diameter, rather more than 4-12ths of an inch.

Localities.—Barton, Muddiford (Highcliff). Mr. Sowerby also gives Highgate, but I do not know of any specimen from that locality. The species is, apparently, confined to the upper beds of the middle eocene deposits, and is not common.

No. 153. *PLEUROTOMA FUSIFORMIS*, *Sowerby*. Tab. XXVII, fig. 1 *a*, *b*.

PLEUROTOMA FUSIFORMIS, *Sow.* 1823. Min. Con., vol. iv, p. 119, t. 387, fig. 1.

— — — *Morris.* 1843. Cat. Brit. Foss., p. 157.

Non *PLEUROTOMA FUSIFORMIS*, *Sow.* 1831. Trans. Geol. Soc., 2d series, vol. iii, p. 418, t. 39, fig. 20.

P. testá elongatá, fusiformi, angustá, subturritá, longitudinaliter costatá, spiraliter fasciatá: spirá elevatá, acuminatá: anfractibús angulatis; ultimo anfractu antice sensim attenuato, in canali longo, lato, terminanti; marginibus posticis concentricè tenuiter lineatis, pauçillulum cavatis; costis rotundatis, ultimo anfractu evanescentibus; fasciis spiralibus numerosis, irregularibus, inequalibus, lineis incrementi scabralis: aperturá lanceolatá; labro arcuato; sinu lato, sub-profundo, in margine collocato.

Shell elongated, narrow, fusiform, longitudinally ribbed, and spirally banded: the spire, which, in the larger specimen figured, consists of eight volutions exclusive of the pullus, is elevated, forming nearly two fifth parts of the whole length of the shell. The whorls are sharply angulated at the shoulders, giving a turreted appearance to the spire; the posterior margins are moderately wide, slightly depressed, a little thickened and crenulated round the suture, and ornamented with fine, concentric, raised lines, two or three of which, immediately behind the shoulder, are stronger than the rest, and granulated by the lines of growth of the sinus; the longitudinal ribs are rather numerous, rounded, and extend to the middle of the whorls, but become obsolete on the body-whorl of the adult shell; the spiral bands over the middle and front parts of the whorls are numerous, unequal, irregular, becoming more distant on the canal, where occasionally fine, thread-like lines rise between them; the bands are

much roughened by the lines of growth, giving a scabrous aspect to the shell: the body-whorl is attenuated very gradually in front, assuming a nearly conical shape, and terminates in a long, rather wide, and nearly straight canal. The aperture is lanceolate, the outer lip moderately arched, and the sinus, which is placed in the margin immediately behind the shoulder, is wide, moderately deep, and almost semicircular in form.

No foreign analogue of this well-marked species has as yet been noticed; and at present *P. fusiformis* appears to be confined to the older eocene strata in the neighbourhood of London, where it is exceedingly rare. Mr. Sowerby, it is true, has applied the name to a *Pleurotoma* from the so-called transition beds between the lower tertiaries and the upper cretaceous formation at Gosau, a notice of which is contained in a memoir 'On the Structure of the Eastern Alps,' by Prof. Sedgwick and Sir Roderick Murchison, published in the 'Geological Transactions' of 1831; but that shell is a short, wide, strongly costated shell, perfectly distinct in character from the Highgate shell, and the name *fusiformis* was used apparently in forgetfulness of its having been previously applied to the present species. The Gosau shell has been since distinguished by D'Orbigny as *P. sub-fusiformis*.

The specimens figured form part of Mr. Wetherell's collection.

Size.—If the larger specimen were perfect, the dimensions would be—axis, 1 inch and 9-12ths; diameter, 6-12ths of an inch. Those of the specimen figured in 'Mineral Conchology' appear to be—axis, 2 inches and 1-12th; diameter, rather more than 7-12ths of an inch.

Locality.—Highgate.

No. 154. *PLEUROTOMA SULCULOSA*. *F. E. Edwards*. Tab. XXVII, fig. 2 *a—c*.

P. testá elongatá, fusiformi, sub-turritá, concentrice sulcatá: anfractibus convexiusculis, angulatis, tuberculatis; marginibus posticis pauvillulum cavatis, transversim interrupte lineatis, ad suturam incrassatis: aperturá oblongo-ovali, in canali longiusculo exeunti; labro valde arcuato; sinu lato, sub-trigono, in margine collocato.

Var. β. Testá tuberculis longitudinaliter compressis, ultimo anfractu evanescentibus, instructá.

Shell elongated, fusiform, transversely sulcated; spire formed of seven or eight volutions, moderately elevated, pointed: whorls rather convex, angulated at the shoulders, where they present a series of oblong, longitudinally compressed, and more or less oblique tubercles; the posterior margins slightly hollowed out, thickened on the sutural edge, round which runs an elevated, sharp line, granulated by the lines of growth of the sinus; the space between this line and the angle of the whorls is occu-

pied by three or four concentric lines, broken into oblong granulations, more or less widely separated by smooth spaces, formed at the successive stages of growth by the margins of the sinus; the angulated shoulders, and somewhat depressed margins of the whorls, give a turreted character to the spire. The tubercles are rather numerous, and prominent in all stages of growth; the transverse furrows deep, but not wide, and separated by rounded ridges, which are narrow near the shoulders, but become broader over the middle and front parts of the whorls, and on the canal. The body-whorl is suddenly contracted near the middle, and produced anteriorly into a wide, moderately long canal. The aperture is of a narrow, oblong, oval shape; the outer lip roundedly arched, almost semicircular in form; and the sinus, which is placed in the middle of the margin, is deep, rather wide, and sub-trigonal.

Specimens occur (*Var. β*, fig. 2 *b*) in which the tubercles are compressed, and a little prolonged, in the direction of the axis, imparting a sub-costellated appearance to the earlier whorls, and becoming obsolete as the shell approaches maturity.

This species presents a very close analogy with *P. fusiformis*, with which, in fact, it may be easily confounded. On comparing the two shells, however, it will be found that, in the present species, the shell is wider; the spire relatively more produced and tuberculated, not costated; the body-whorl more contracted, and less conical, in front; the canal wider and shorter; the outer lip more roundedly arched; and the sinus deeper, more trigonal, and placed nearer the middle of the margin. These distinctions, and the different ornamentation, which consists of deep conspicuous furrows instead of the rough spiral bands which characterise *P. fusiformis*, appear to me to justify the separation.

Size.—The dimensions of the largest specimen figured would be, if the shell were perfect—axis, 1 inch and 5-12ths; diameter, not quite half an inch.

Localities.—Highgate and Potters' Bar, at both of which localities it is rather scarce.

No. 155. *PLEUROTOMA ACUMINATA*, *Sowerby*. Tab. XXVII, fig. 3 *a—d*.

PLEUROTOMA ACUMINATA, *Sow.* 1816. *Min. Con.*, vol. ii, p. 105, t. 146, fig. 4.

— — *D'Orb.* 1850. *Index Paléont.*, vol. ii, p. 359, No. 420.

— — *Morris.* 1854. *Cat. Brit. Foss.*, 2d edit., p. 269.

Nec *PLEUROTOMA ACUMINATA*, *Nyst.* 1836. *Rech. coq. foss. de Hoesselt et Vliermael*, p. 32, No. 83.

nec — — *De Kon.* 1837. *Desc. des coq. foss. de Basele Boom, &c.*, p. 24, No. 24.

nec — — *Nyst.* 1843. *Bull. Soc. Géol. de France*, vol. xiv, p. 454, No. 27.

nec — — *Ib.* 1843. *Descr. des coq., &c., de la Belgique*, p. 519, t. 42, fig. 1 *a, b*.

P. testá elongatá, angustá, turritá, acuminatá, longitudinaliter costatá, concentricè sulcatá: anfractibus convexiusculis; marginibus posticis angustis, concavis, transversim granuloso-lineatis, ad suturam plicatis; sulcis concentricis confertis, antice distantioribus; spatiis sulcos separantibus lincis incrementi granulatis: aperturá oblongo-ovali, in canali lato, longiusculo exeunti; labro arcuato; sinu fere semicirculari, in margine collocato.

Var. α.—Testá latiori, breviori.

Var. β.—Testá lævigatá; sulcis transversis semi-obliteratis.

Shell elongated, narrow, turreted, pointed, longitudinally ribbed and concentrically furrowed; the spire, formed of eight or nine volutions, much produced, equalling in length three fifths of the whole shell. The whorls are slightly convex; the posterior margins narrow, channeled, ornamented with several concentric raised lines, a little thickened at the suture, and plicated by the lines of growth of the sinus, which, in some specimens, are prominent over the whole margin, granulating the concentric lines; the last whorl is rather suddenly contracted in front, and terminates in a wide but not very long canal. The furrows in front of the shoulder are close-set, regular and equal, but, where the whorl begins to contract, they become more distant and irregular: the surface of the intervening spaces is granulated by longitudinal ridges formed by the elevated lines of growth; the longitudinal ribs are rather numerous, narrow, and extend to the middle of the whorls. The aperture is of a narrow, oblong-oval form; the outer lip but slightly arched, and the sinus, which is wide and almost semicircular in shape, is placed a little in front of the middle part of the margin. Specimens occasionally occur (*Var. α*, fig. 3 *b, c*) in which the shell is wider and shorter, and the spire is relatively not so much produced; and others, again (*Var. β*, fig. 3 *d*), in which the ribs disappear as the shell is enlarged, the transverse furrows are shallower and more closely set, and the lines of growth less prominent, giving to the surface a levigated appearance, as if it had been rubbed smooth.

MM. Nyst and De Koninck have severally described certain shells from Basele, Boom, and Kleyn-Spauwen, which they have referred, erroneously in my opinion, to the present species. In the general character of the ornamentation these shells apparently agree with the English shells; but with them, judging from the figure given by Nyst, the spire is relatively longer, the whorls more convex, the posterior margins less depressed, giving a more conical and less turreted form to the spire; the body-whorl more suddenly contracted, and the columella more arched: the characters, however, which most clearly distinguish the Belgian shells are the form and position of the sinus, which is wide and very shallow, and is placed on the shoulder, and not, as in the present species, in the margin of the whorls.

Size.—Axis, 1 inch and 3-12ths diameter, 4-12ths of an inch.

Localities.—Highgate, Hornsey, Potters' Bar, and Clarendon Hill, at which last locality both varieties occur.

The specimens represented by figs. 3 *a* and 3, form part of Mr. Wetherell's collection.

No. 156. *PLEUROTOMA PYRULATA*, *Deshayes*. Tab. XXVII, fig. 7 *a, b*.

PLEUROTOMA PYRULATA, *Desh.* 1824–37. *Descr. des coq. foss., &c.*, vol. ii, p. 449, t. 66, figs. 1–3.

P. testá elongatá, angustá, piruliformi, spiraliter lineatá: spirá mediocriter elevatá, sub-conicá; anfractibus angulatis, in medio convexiusculis, antice sensim attenuatis; marginibus posticis declivis, vix cavatis, concentricè tenuissime lineatis; ultimo anfractú in canali præ-longo terminanti; lineis spiralibus acutis, irregularibus, inæqualibus, lineis incrementi fortiter decussatis: aperturá elongato-ovali; labro parum arcuato; sinu latiusculo, profundo, in margine collocato.

Shell elongated, narrow, concentrically lined: the spire, formed of eight or nine volutions, is pointed and moderately elevated, not equalling in length a third part of the whole shell; the whorls are convex at the middle, bluntly angulated at the shoulders; the posterior margins but slightly depressed, giving a nearly conical form to the spire; slightly thickened at the edge, where they present two strong, prominent, raised lines, which run round the suture, and form a border to the whorls; the space between the suture and the shoulders is slightly channeled, and covered with several very slender, unequal, raised lines; the body-whorl diminishes gradually towards the base, and terminates in a very long and nearly straight canal. The gradual tapering of the whorls, joined to the rather short, conical spire, gives to the shell somewhat of the form of a long, narrow pear, from which appearance the specific name is taken. The spiral lines over the middle and front parts of the whorls are numerous, irregular, and unequal, slender thread-like lines alternating with thicker and more prominent lines; all are beautifully and regularly decussated by the strongly marked lines of growth. The aperture is of a long, narrow, oval form; the outer lip slightly expanded towards the middle; and the sinus, which is placed in the middle of the margin is deep and not very wide.

The French shells, in their typical form, are narrow, with a rather short spire; but, apparently, specimens from different localities present considerable variations, not only in the relative height of the spire and width of the shell, but also in the striation. The specimens from Compiègne, for instance, as M. Deshayes has recorded, have the spire more produced, the angle of the whorls more prominent, and the con-

centric lines more numerous; and in some specimens from Cuise-Lamotte, in my cabinet, the spire is also much elevated, the shell relatively narrower, and the concentric lines close-set, slender, and regular. In the English specimens the relative height of the spire and the character of the concentric lineation agree with those of the specimens from Compiègne; but the shell is wider, and the margins of the whorls are not so much depressed. These differences, however, attributable probably to local conditions only, do not suggest a doubt of the correctness of the identification.

Size.—Axis, rather more than 5-6ths of an inch (11 millim.); diameter, 3-12ths of an inch (rather more than 6 millim.).

Localities.—Clarendon Hill. French—Compiègne (fide *Desh.*); Cuise-Lamotte, Trosly-Breuil (fide *Graves*); Laon (fide *Mellev.*) MM. Deshayes and D'Orbigny also give Parnes; but M. Graves speaks with doubt of that locality.

No. 157. *PLEUROTOMA TEREBRALIS*, *Lamarck*, var. Tab. XXVII, figs. 10 *a—k*.

PLEUROTOMA TEREBRALIS, *Lamk.* 1804. *Anm. du Musée*, vol iii, p. 266, No. 20.

— — *Ib.* 1822. *Hist. nat., &c.*, vol. vii, p. 101, No. 25.

— — *De Blainv.* 1826. *Dict. des sci. nat.*, vol. xli, p. 391.

— — *Desh.* 1832. *Encl. méth. (Vers.)*, vol. iii, p. 799, No. 21.

— — *Ib.* 1824-1837. *Desc. des coq., &c.*, vol. ii, p. 455, t. 62, figs. 14—16.

Var. 1st. DITROPIS; fig. 10 *a*. *P. testá parvulá, elongatá, fusiformi, angustá, turritá, lineis spiralibus elegantissime granulatis ornatá; spirá elevatá, acuminatá; anfractibus bicarinatis; marginibus posticis depressis, concavis, ad suturam granulatis, cæteris lævibus, vel tenuissime plicatis; carinâ posticâ acutâ, denticulatâ; carinâ anticâ fascioli-formi, denticulato-plicatâ; lineis spiralibus plus minusve distantibus, inæqualibus; ultimo anfractu antice valde attenuato in canali longo exeunti; sinu lato, fere semicirculari, in margine collocato.*

Var. 2d. CONCINNA; fig. 10 *i, k*. *Testá parvâ, bicarinatâ, lineis spiralibus peræque granulatis, undique, etiam in marginibus anfractuum, ornatâ; carinâ anticâ granulatâ; lineis spiralibus numerosis.*

Var. 3d. GYRATA; fig. 10 *b, d*. *Testá bicarinatâ; carinis fascioli-formibus, crassis, oblique plicato-denticulatis; lineis spiralibus inæqualibus, granulosis.*

Var. 4th. PULCHERRIMA; fig. 10 *e*. *Testá parvâ, bicarinatâ; carinâ posticâ denticulatâ; carinâ anticâ rotundatâ, lævi; lineis spiralibus elevatis, rotundatis, simplicibus vel obsolete granulatis, suprâ canalem confertis, cæteris distantibus.*

Var. 5th. REVOLUTA; fig. 10 *f*. *Testá bicarinatâ; marginibus posticis anfractuum ad suturam lævissime crenulatis; carinâ posticâ acutâ, obsolete plicato-denticulatâ, superne revolutâ; carinâ anticâ lineisque spiralibus granulatis.*

Var. 6th. PAGODA; fig. 10 h. Testá latiori, fasciis et lineis spiralibus elevatis cinctá: anfractibus bicarinatis, ad suturam marginatis; carinis simplicibus, singulis unico sulco exaratis; cariná posticá superne revolutá; fasciis numerosis, inæqualibus, lævibus.

The typical form of this elegant *Pleurotoma* is distinguished by the smooth concave margins of the whorls, by the remarkable regularity of the denticulation on the keel, resembling the teeth of a circular saw, and by the close-set rows of even, bead-like granulations, which cover the middle and front parts of the shell, slightly diminishing in size as they approach the anterior extremity of the canal. The shell, upon which Lamarck formed the species, was found at Parnes; and, apparently, the ornamentation which characterises it is confined in the French specimens to those from the "calcaire grossier." The species occurs, also, in the older eocene formations of that country; but the shells from them are generally of smaller dimensions, and present more or less strongly marked deviations from the typical ornamentation. In England the species has not as yet been found above the older eocene deposits; several forms, indeed, occur in them; one or two of which apparently agree with French varieties; but neither among them, nor, as I believe, among those from the "groupes glauconieux" of France, does the exact ornamentation of the typical *P. terebralis* of Lamarck occur.

In the first variety (*ditropis*), which corresponds with specimens in my cabinet from Cuisse-Lamotte, the shell is much smaller than that of the type, elongated, fusiform, narrow, turreted, and beautifully ornamented with concentric rows of regular bead-like granulations; the spire is pointed and much produced, being rather more than two fifths of the length of the whole shell. The whorls are somewhat convex, sharply angulated, and carinated at the shoulders; the posterior margins rather depressed, slightly channeled, and perfectly smooth, except round the suture, where they are bordered by a single row of small regular granulations; occasionally a specimen occurs in which the smoothness of the surface is broken by very fine curved plications formed by the successive margins of the sinus. The keel on the shoulder is sharp, prominent, and denticulated with great regularity: in front of this, just where the whorl begins to contract, is a thick concentric band, rather obliquely plicated, and so prominent as to present the appearance of a second keel on the whorl; the ends of the plications project beyond the edges of the band, giving to it a denticulated appearance. The concentric rows are unequal, irregular, and more or less distant in different specimens, but closer and more regular towards the anterior extremity. The last whorl is much attenuated in front, and terminates in a moderately long canal: the sinus is rounded, deep, and wide, occupying almost the entire width of the margin.

In the next variety (*concinna*) the shell is somewhat larger than that of the preceding variety, but yet smaller than that of the type; the front keel is narrower and less prominent than in the variety *ditropis*, and is evenly granulated; the concentric rows

of granulations are more numerous, and the margins of the whorls present, in addition to the sutural row of beads, three very slender concentric lines granulated by the lines of growth of the sinus. It has been before stated that one of the more prominent characters of the true *P. terebralis* is taken from the perfectly smooth concave margins of the whorls; and the granulated margins in the present case would apparently indicate a distinct species; but the occasional occurrence of a plicated margin in the last variety prepares the way for the present form; and as this agrees in all the more important characters with the variety *ditropis*, I have regarded it as merely another variety of *P. terebralis*.

The shell in the variety *gyrata* (fig. 10 *b—d*) is smaller than that of the type, and doubly keeled; but both keels are thick, band-like, and strongly and obliquely plicated, and have a denticulated appearance from the plications being continued over the edges of the bands; the plications, following the curve of the line of growth, are less oblique on the anterior keel than those on the posterior keel. A single slender raised line, finely granulated, traverses the space between the keels; the front part of the whorl is ornamented with several concentric raised lines, granulated with great regularity; of these, the one next to the anterior keel, in some specimens (as in fig. 10 *b*), and that next but one, in others (as in figs. 10 *c* and *d*), is the thickest and most prominent; the others slightly diminish in size as they approach the anterior extremity of the canal.

The next variety, *pulcherrima* (fig. 10 *e* and *g*),* appears to correspond with the variety *a* from Compiègne, noticed by M. Deshayes. In this variety the shell is small and doubly-keeled; the posterior or shoulder-keel denticulated, the anterior keel rounded and obscurely plicated, almost smooth; the front part of the whorls is ornamented with several distant, thickish, concentric lines, which also are smooth and simple, or but very feebly granulated; the whorls are bordered round the suture by a thickish raised line, obscurely granulated or plicated; the margins and the spaces between the keels and between the concentric lines are perfectly smooth.

The variety *revoluta* (fig. 10 *f*) is a modification of the variety *pulcherrima*; in it the sutural edges of the whorls are very faintly crenulated; the shoulder-keel is sharp, obscurely plicated and denticulated, and the edge is bent upwards: the anterior keel is round and feebly plicated, and the concentric lines are slender and finely granulated.

In the last variety to be noticed, the variety *Pagoda* (fig. 10 *h*), the granulation and denticulation, which in the typical form and the preceding varieties form more or less prominent characters, are wanting; and a new mode of ornamentation prevails. In this variety the shell, which is relatively wider, is doubly-keeled, and ornamented with simple spiral bands; the margins of the whorls are concave, and

* I have adopted for the shells forming this variety, the name by which they have been distinguished as a species in Mr. Wetherell's cabinet.

quite smooth, except where two slender, faintly crenulated, raised lines form a border round the suture. The keels are band-like and simple; the surface of each is traversed by a shallow but conspicuous furrow; the edge of the shoulder-keel is sharp, smooth, and bent upwards like that of the keel which characterises the preceding variety. The space between the two keels and the surface of the front part of the whorls is ornamented with numerous narrow, unequal, round-edged bands, between some of which a slender line occasionally appears; these bands are smooth, or but slightly roughened by the lines of growth.

A form intermediate between and connecting the last two varieties occurs, in which the sharp, smooth-edged, and furrowed shoulder-keel of the variety *Pagoda* is associated with an obscurely plicated anterior keel, and faintly granulated spiral lines.

Although the shell for which the variety *Pagoda* is proposed, differs so much in the ornamentation from the typical form, I do not regard it as specifically distinct. In the several varieties described, the characteristic ornaments of the species have been modified, and have become gradually less prominent, until at last, in the variety *revoluta*, they are almost obliterated; and the intermediate form, before noticed, connects that variety with the one in question, which, in fact, merely presents in strength a character of ornament which has already appeared in other varieties.

All the varieties are rare except the varieties *gyrata* and *Pagoda*, which appear to be more abundant.

Size.—Of the var. *ditropis*—axis, 5-12ths of an inch; diameter, 2-12ths of an inch: of the var. *concinna* and *pulcherrima*—axis, 7-12ths of an inch; diameter, rather more than 3-12ths of an inch: of the var. *gyrata*—axis, 1 inch, nearly; diameter, rather more than 5-12ths of an inch: and of the var. *Pagoda*, if the shell were perfect—axis, 1 inch and 2-12ths, nearly; diameter, 5-12ths of an inch.

Localities.—For the var. *ditropis*—Highgate, Potters' Bar, Hornsey, Hampstead; for the var. *concinna*—Highgate, Potters' Bar, Hornsey, Finchley; for the var. *gyrata*—Hornsey, Southampton, Shenfield; for the var. *pulcherrima*—Highgate and Clarendon Hill; and for the var. *revoluta* and *Pagoda*—Clarendon Hill. *French*—Parnes, Grignon, Beyne, Mouchy-le-Châtel, Compiègne (fide *Desh.*), Chaumont, Amblainville, Cuisse-Lamotte, Pont-Sainte-Maxence (fide *Graves*).

The specimens, fig. 10 *b* and *k*, are from Mr. Wetherell's cabinet.

No. 158. *PLEUROTOMA MICRODONTA*, *F. E. Edwards*. Tab. XXVII, fig. 4.

P. testá elongatá, fusiformi, tuberculatá, spiraliter exilissime lineatá: spirá elevatá, 3-conicá: anfractibus angulatis, unicá serie tuberculorum denti-formium munitis: marginibus posticis latis, paucillum cavatis, ad suturam cingulo triplici, distanter plicato, cinctis:

ultimo anfractu antice repentissime coarctato, in canali angusto, longiusculo, terminanti; lineis spiralibus confertis, inæqualibus, nonnullis eminentioribus, denticulatis: aperturâ oblongo-ovali; labro valde arcuato, intus plicato; sinu lato, sub-trigono, in margine collocato.

Shell elongated, fusiform, tuberculated, and ornamented with very fine, concentric, raised lines; spire nearly conical and much produced, exceeding one half of the whole shell in length; whorls convex, sharply angulated at the shoulders, where they present a single row of small, rather close-set, tooth-shaped tubercles; the posterior margins wide, frequently extending almost to the angle of the preceding whorl, slightly channeled, and bordered round the suture by three sharp, elevated lines, crossed by distant, oblique plications, corresponding with the tubercles on the shoulders of the whorls; the space between the suture and the shoulder is covered with very fine and nearly equal concentric lines. The spiral lines over the middle and front parts of the lines are numerous, very slender, but unequal; every fourth or fifth line being rather thicker and more prominent than the rest, and denticulated; the intermediate lines are simple, nearly equal, and so fine as to be barely perceptible by the naked eye. The body-whorl is suddenly much contracted in front, and terminates in a narrow, but not very long canal: the aperture is of an oblong oval form; the outer lip much arched and plicated within, and the sinus, which is wide and sub-trigonal in shape, is placed a little in front of the middle part of the margin.

The present species presents some resemblance to *P. cymæa*, but is easily distinguishable by the more elevated spire, the more numerous and smaller tubercles, the character of the transverse ornamentation, and the shorter canal.

Size.—Axis, 1 inch and 2-12ths; diameter, 5-12ths of an inch, nearly.

Localities.—Highcliff, where it is very abundant, and Bracklesham Bay.

Section I—Shells fusiform.

- A. *Sinus in the posterior margin of the whorl.* } continued.
 *b. Canal short or indistinct.**

No. 159. *PLEUROTOMA ATTENUATA*, Sowerby. Plate XXVII, fig. 6 *a—c*.

PLEUROTOMA ATTENUATA, Sow. 1816. Min. Con., vol. ii, p. 103, t. 146, fig. 1.

— — *Ib.* 1850. Dixon's Geol., &c., of Sussex, p. 102, t. 6, figs. 11, 14.

— — *Morris.* 1854. Cat. Brit. Foss., 2d edit., p. 269.

* The sub-divisions dependent on the length of the canal are, it is unnecessary to say, merely artificial, and towards the extremes of the two, species occur which may be referred, apparently with equal propriety to either sub-division: in shells with a short canal, however, the anterior notch is generally wider and deeper, and consequently the crest on the columella will be more prominent.

Nec *PLEUROMOMA ATTENUATA*, *Desh.* 1824-37. *Descr. des coq. foss., &c.*, vol. ii, p. 483, t. 68, figs. 6, 8.

nec — — *Dujar.* 1837. *Mém. Soc. Géol. de France*, vol. ii, p. 291, t. 20, fig. 22.

P. testá elongato-fusiformi, turritá, costatá, undique spiraliter lineatá; spirá elevatá, acuminatá; anfractibus angulatis, unicá serie nodorum spiniformium, costas coronantium, armatis; marginibus posticis latis, declivis, [concavis, ad suturam pauillum incrassatis, tenuiter crenulatis; ultimo anfractu antice sensim attenuato, in canali longiusculo, lato, terminanti; costis brevibus, sub-distantibus, rotundatis; lineis spiralibus numerosis, in marginibus tenuibus; ceteris inæqualibus: aperturá lanceolatá; labro arcuato; sinu lato, subtrigono, in margine collocato.

Shell elongated, fusiform, turreted, longitudinally ribbed, and ornamented with concentric raised lines: the spire, formed of eleven or twelve volutions exclusive of the pullus, is much elevated and pointed; the whorls, angulated at the shoulders, are gradually attenuated towards the base, assuming an almost conical form; the body-whorl terminates in a wide, moderately long canal, rather deeply notched at the anterior extremity; the posterior margins are wide, slightly bent towards the preceding whorls, channeled along the middle, thickened at the sutural edge, and bordered by two thickish, prominent, raised lines, granulated or feebly plicated by the lines of growth. The ribs are rather distant, short, oblique, rounded, and terminate at the shoulder in large, transversely compressed, spiniform tubercles, the bases of which are frequently prolonged backwards half-way across the posterior margin. The whole surface of the whorls is covered with close-set concentric raised lines, which are thread-like and nearly equal on the margins, but irregular and unequal over the middle and front parts of the whorls; one or two more or less slender lines intervening between thicker and more prominent lines: the whole surface is roughened by the lines of growth, which in the Bracklesham Bay specimens are very prominent, and give a coarse, rugged character to the shell. The aperture is of a long, narrow, lanceolate form; the outer lip moderately arched; and the sinus, which is wide, not very deep, and sub-trigonal in shape, is placed in the margin. The columella is nearly straight, and presents a large prominent crest or comb at the anterior extremity.

M. Deshayes (*loc. cit.*) has given the specific name *attenuata* to certain shells from the older eocene beds of France, quite distinct from the present species, to which, in point of priority, the name belongs; and Dujardin has fallen into the same error with regard to a *Pleurotoma* from Touraine. D'Orbigny, in his 'Prodrome,' has distinguished the French eocene shells by the name *sub-attenuata*, and the miocene shells by that of *pseudo-attenuata*.

Size.—Axis, 4 inches, nearly; diameter, 1 inch and 2-12ths.

Localities.—Although Mr. Sowerby (Dixon's 'Sussex,' p. 102) and Mr. Morris

both cite Barton as a locality for this well-marked species, I have not been fortunate enough to meet with any specimen of it from that locality; it is confined, I believe, to the lower beds of the middle eocene formations. It is found plentifully at Bracklesham Bay, of which locality it may be said to be one of the characteristic fossils: it also occurs at Stubbington and White-Cliff Bay, and in the synchronous beds at Bramshaw.

NO. 160. *PLEUROTOMA CONICA*, *F. E. Edwards* Tab. XXVII, fig. 8.

P. testá elongatá, fusiformi, omnino concentrice sulcatá, unicá serie tuberculorum munitá; spirá conicá, elevatá, dimidium totius testæ in longitudine superanti: anfractibus convexiusculis, antice subito coarctatis, suturá conspicuá separatis; marginibus posticis latis, paucilulum declivis, cavatis; ultimo anfractu in canali longiusculo terminanti; tuberculis longitudinaliter compressis, obliquis, curvis: aperturá oblongo-ovali; labro arcuato; sinu lato, sub-trigono, in parte anticá marginis collocato.

Shell elongated, fusiform, concentrically furrowed, and bearing on the shoulders a single row of tubercles: the spire conical, rather thick, and much elevated, exceeding one half of the whole shell in length. The whorls are slightly convex at the shoulders, rather suddenly contracted in front, and separated from each other by a very conspicuous suture; the posterior margins are wide, very slightly depressed, rather deeply channeled along the middle, and a little thickened on the sutural edge. The tubercles, which are somewhat numerous, are longitudinally compressed, narrow, oblique, and curved; the concentric furrows are nearly regular, shallow, and separated by narrow, rounded ridges, of which, as they approach the beak, every alternate one becomes more prominent than the rest. The aperture is of an oblong-oval form, and terminates in front in a slightly produced, widish canal; the outer lip is moderately arched; and the sinus, which is placed in the very front part of the posterior margin, almost on the shoulder of the whorl, is wide and sub-trigonal in shape.

This species, characterised by its thick, elevated, conical spire, is apparently confined to the older eocene beds in the neighbourhood of London. I have not met with any specimen of it either from Clarendon Hill or from the synchronous formations in Hampshire.

Size.—Axis, 11-12ths of an inch; diameter, 4-12ths of an inch.

Locality.—Highgate.

No. 161. *PLEUROTOMA DESMIA*, *F. E. Edwards*. Tab. XXVII, fig. 5.

P. testá elongatá, fusiformi, tuberculatá, spiraliter fasciolatá et lineatá: spirá sub-conicá, valde productá: anfractibus convexis, sub-angulatis, longitudinaliter plicatis; marginibus posticis depressis, concavis, concentrice lineatis, ad suturam cingulo duplici, distanter plicato, cinctis; ultimo anfractu repente coarctato, incanali breviculo exeunti: fasciolis numerosis, antice simplicibus, cæteris inæqualibus, nonnullis majoribus, crasse granulatis, cum aliis minoribus simplicibus, alternantibus: aperturá ovali; labro valde arcuato, intus plicato; sinu lato, sub-trigono, in margine collocato.

Shell elongated, fusiform, tuberculated, and ornamented with concentric bands and raised lines; the spire rather thick, nearly conical and much elevated, almost equalling two thirds of the whole shell in length: the whorls short, convex, and obscurely angulated at the shoulders, where they present a double row of small, transverse tubercles; the posterior margins much depressed, hollowed out, and concentrically lined along the middle, and bordered round the suture by a double line, distantly and obliquely plicated by the lines of growth of the sinus, which are very prominent over the whole width of the margin; the last whorl is suddenly contracted in front, and terminates in a rather short and narrow canal, widely notched at the anterior extremity. The spiral bands over the middle and front parts of the whorls are divided with much regularity into rows of coarse, oblong granulations, placed nearly below each other in an oblique direction, following the curve of the outer lip, and giving an appearance of plication to the whorl: the rows of granulations, which are separated by thickish, raised lines, rounded on the surface, diminish in size towards the front part of the whorls, until, on reaching the canal, they barely exceed the intervening lines in size, and the granulations become nearly obliterated. The aperture is of an oval form; the outer lip much arched, projecting in front, and plicated within; and the sinus, which is placed rather towards the front of the margin, is wide, moderately deep, and sub-trigonal in form. The columella is slightly curved, and presents in front, at the anterior extremity, a conspicuous crest or comb.

The present species, in the young state, somewhat resembles *P. microdonta*, but the shell is narrower, the spire relatively longer, and the canal shorter; the regular granulations which characterise the concentric ornamentation also render it easily separable. It is apparently confined to the middle eocene formations of Barton, where it is not uncommon.

Size.—Axis, 1 inch and 8-12ths, nearly; diameter, half an inch.

No. 162. PLEUROTOMA INNEXA. Solander. Tab. XXVIII, fig. 1, a—c.

MUREX INNEXUS. Sol. 1766. Brand. Foss. Hant., p. 19, fig. 30.

PLEUROTOMA INNEXA. Forbes. 1856. Tert. Fluv. Mar. Format., &c.; Mem. Geol. Surv., p. 154, t. 5, fig. 5.

P. testá elongato-fusiformi, reticulato-crenulatá: spirá sub-conicá, elevatá: anfractibus vix convexis, lineas elevatas concentricas, et costellas longitudinales, sese decussantes, gerentibus; marginibus posticis angustis, spiraliter sulcatis, ad suturam granulatis; ultimo anfractu in canali patulo, per-brevi, exeunti; costellis acutis, usque ad basin tendentibus, arcuatis, tuberculatis: aperturá oblongo-ovali, angustá; labro aliforme, intus nonnunquam obscure denticulato; sinu lato, rotundato, in margine collocato; labio angusto, incrassato.

Shell elongated, fusiform, and ornamented with concentric and longitudinal raised lines, nearly equally prominent, and which, from their decussation, present the appearance of fine network. The spire is thick, nearly conical, and much elevated, almost equalling two thirds of the entire length of the shell. The whorls, eight or nine, exclusive of a pointed pullus of three volutions, are short, very slightly convex, nearly flat-sided; the posterior margins are very narrow, and present a more or less shallow transverse furrow; they are thickened on the edge of the suture, which is bordered by a single row of small, round, or somewhat oblong, granulations. The longitudinal ribs, which are narrow and sharp, extend from the marginal granulations to the very front of the whorl, and are rather strongly curved over the middle; in general the ribs are a little more prominent than the concentric lines, and are thickened at the points of decussation, like the knots of a net, forming rows of small tubercles, the last of which, immediately in front of the margin, is more prominent than the rest. The concentric lines are irregular, close-set at the base, distant over the front of the whorl, and become more or less crowded as they approach the posterior margin. The aperture is of a narrow, oblong-ovate form, and terminates in a short, wide canal, rather deeply notched in front; the outer lip is much arched, sharp at the edge, thickened within, and presents three or four thick, tooth-like callosities, of which the posterior one in front of the sinus is large and prominent; the inner lip is narrow and thickened; the columella is slightly curved, and bears in front a small crest; the sinus is rounded and wide, occupying the whole width of the margin.

The figure of this shell, given by Brander, is not executed with the felicity which usually characterises that author's work, and to this circumstance, probably, is to be attributed the difficulty which the Continental writers have had in identifying the species. Thus Lamarck and, after him, Deshayes, referred *P. innexa*, although with doubt, to *P. undata* (Lamk.), from which species, however, it is easily distinguished

by the narrower form of the shell, the more conical spire, the reticulated character of the ornamentation, the narrower margin of the whorls, and the shape of the sinus. Again, M. Nyst, with equal hesitation, has suggested the identity of *P. innexa* with his *P. Stoffelsii*; the latter shell, however, differs in the more pointed spire, the greater length of the whorl, the absence of the longitudinal lineation, and the position of the sinus, which, judging from the figure given by the author, is on the shoulder of the whorl. To *P. dubia* (Def.), a species from the Calcaire grossier, *P. innexa* presents a very close resemblance; but the French shell is much smaller, the spire less obtuse, the costellæ fewer, more prominent in character, bifurcated and not decussated, and the transverse lineation is comparatively feeble. I am indebted to M. Deshayes for some specimens of a species from Damery, hitherto undescribed, which appears to be smaller and narrower than the present species, but in other respects to agree closely with it. A comparison of *P. innexa* with a larger series of the Damery shells will probably establish the identity.

Size.—Axis, 9-12ths of an inch; diameter, 3-12ths of an inch.

Localities.—Highcliff, Barton, Alum Bay (Stratum No. 29, Prestwich), Colwell Bay, Bracklesham Bay, and Whitecliff Bay (fide Forbes).*

No. 163. *PLEUROTOMA INFLEXA*. *Lamk.* Tab. XXVIII, fig. 3, *a—c*.

PLEUROTOMA INFLEXA. *Lamk.* 1804. Ann. du Musée, vol. iii, p. 267, No. 22.

— SEMICOLON. *Sow.* 1816. Min. Con., vol. ii, p. 104, t. 146, fig. 6.

— INFLEXA. *Lamk.* 1822. Hist. nat., &c., vol. vii, p. 101, No. 27.

— — *Desh.* 1824-37. Coq. foss., &c., de Paris, vol. ii, p. 475, t. 66, figs. 11—13.

— — *Bronn.* 1849. Index Palæontol., p. 1005.

— SEMICOLON. *Bronn.* 1849. Idem, p. 1009.

— INFLEXA. *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 357, No. 359.

— SEMICOLON. *D'Orb.* 1850. Idem, p. 359, No. 423.

— INFLEXA. *Sow.* 1850. Dixon's Geol., &c., of Sussex, p. 103.

— DUBIA? *Defr.* 1824-37. *Desh.*, Coq. foss., &c., de Paris, vol. ii, p. 481, t. 67, figs. 12—14.

Nec — SEMICOLON. *Nyst.* 1836. Coq. foss. de Hoesselt, &c., p. 32, No. 84.

nec — — *Nyst.* 1843. Coq., &c., de Belgique, p. 527, No. 451.

nec — — *S. Wood.* 1848. Crag. Moll., p. 54, t. 6, fig. 3, *a, b*.

P. testá fusiformi, sub-turritá, costellatá, transversim obsolete lineatá: anfractibus numerosis, angustis, sub-planis, ad suturam crenulatis; costellis in medio inflexis, sæpissime

* I suspect that specimens of *P. inflexa* (Lamk.), a form belonging to the Bracklesham Bay series of deposits, have been erroneously referred to *P. innexa*, which that species much resembles. I do not know of any specimen of *P. innexa* coming either from Bracklesham Bay, or from Stubbington, Bramshaw, or Brook.

bifurcatis; ultimo anfractu brevi, ad basin tenuissime striato: aperturâ ovali, in canali brevi, mediocriter lato, exeunti; labro tenuissimo, intus plicato; sinu lato, minime profundo, sub-semicirculari, in margine collocato.

Shell elongated, narrow, ribbed, and spirally lined: spire elevated, formed of eight or nine volutions exclusive of the pullus: whorls slightly convex, short, and thickened at the sutural margin, which is ornamented with a single row of bold, roundish or oblong beads, imparting somewhat of a turreted character to the spire. The surface of the whorls presents numerous costellæ, long, narrow, curved, swelled at the top, and corresponding with the marginal granulations, so as to resemble a semicolon, from which circumstance the name given by Sowerby was taken; the costellæ, as they pass over the centre of the whorl, bifurcate and disappear towards the base of the shell: the concentric lines are not very prominent, but are most conspicuous on the anterior part of the shell, becoming feeble as they ascend the whorl; they become almost obsolete in the adult shell. The aperture is ovate, one third of the whole length of the shell, and terminates in a short, moderately wide canal; the outer lip is slightly arched, very thin, and plicated within; the sinus is wide, shallow, nearly semicircular, and placed in the margin.

This species presents a very close resemblance to *P. innexa*, of which many may perhaps be inclined to regard it as a local variety. The shell, however, is narrower; the spire more slender; the sutural granulations and the extremities of the costellæ closely approximated instead of being separated by a wide, well defined furrow; the costellæ themselves bifurcated, and the transverse lineation closer and less prominent than in *P. innexa*.

It is difficult to distinguish *P. dubia* (Def.) from the present species. In Defrance's species the longitudinal ribs are fewer and rounder; but the ornamentation of the two appears to be similar in the essential characters, and I should have regarded the two species as identical. M. Deshayes, however, with the advantage of an extended comparison, has considered *P. dubia* as distinct, an opinion in which both Bronn and D'Orbigny concur, and I have therefore cited Defrance's species with a doubt as to the identification.

Nyst has referred some shells from Vliermael to *P. semicolon* (Sow.), which are described as granulated, angulated at the shoulders, and concentrically striated, but not as being costellated; these shells cannot, therefore, be considered as correctly identified.

The Crag Pleurotomæ, referred by Mr. S. Wood, doubtingly, to this species, appear to be distinct; they are both broader shells, with angulated and strongly tuberculated whorls, the posterior margins of which are wide and broadly concave; and the costæ, which in the present species form a prominent character, appear to be obscure or wanting; while, on the other hand, the transverse lineation, which in *P. inflata* is a subordinate character, is in the Crag shells strong and distinct;

the sinus also is placed on the shoulder. The variety (fig. 3, *a*) somewhat resembles the *P. denticula* of Basterot, and the other shell (fig. 3, *b*) more nearly approaches the typical form of *P. plebeia*. Mr. Wood speaks of *P. semicolon* (Sow.) as being a common and well-known Barton shell; but I have never seen a specimen from that locality. The species appears to be limited to the Bracklesham Bay sands and the synchronous beds; it is rare.

Size.—Axis, 7-12ths of an inch (15 millim.); diameter, 2·3-12ths of an inch (5 millim.).

Localities.—Bracklesham Bay, Stubbington, Bramshaw, Brook. *French*: Grignon, Mouchy (fide Desh.), Les Groux, Hermes, Cuisse-Lamotte, Ver, Acy-en-Mulcien (fide Graves).

NO. 164. PLEUROTOMA LEPTA. *F. E. Edwards*. Tab. XXVIII, fig. 10, *a—c*.

P. testá parvá, fusiformi, gracili, spiraliter lineatá, semi-costellatá: spirá elevatá: anfractibus depresso-convexis, ad humeros angulatis; postice unico sulco profunde exaratis, ad suturam granulato-marginatis; lineis spiralibus elevatis, acutis, haud distantibus; costellis crebris, per-brevibus: aperturá angusto-ovali, antice in canali brevi, indistincto, terminanti; sinu lato, semicirculari, in margine collocato.

A small, slender, fusiform shell, spirally lined, and ribbed: the spire narrow, pointed, elevated, forming nearly two thirds of the whole length of the shell: the whorls flatly convex, angulated at the shoulders; the posterior margins furrowed by a deep sulcus, and somewhat thickened and granulated round the suture; the concentric lines elevated, sharp, and moderately close; the longitudinal ribs rather numerous, very short, not extending beyond the middle of the whorls, narrow, and slightly oblique. The aperture is narrow, oval, terminating anteriorly in a wide, short, indistinct canal; and the sinus, which is wide and semicircular, is placed in the margin.

This species is closely allied to *P. inflexa*, but the shell is slenderer, with a more broadly furrowed posterior margin; the costellæ also are shorter, the transverse lineation more prominent, and the sinus wider and more rounded.

Size.—Axis, rather more than 3-12ths of an inch; diameter, rather more than 1-12th of an inch.

Localities.—Stubbington and Bracklesham Bay, at both of which places it is rare.

No. 165. *PLEUROTOMA COARCTATA*. *F. E. Edwards*. Tab. XXVIII, fig. 12, *a—c*.

P. testá sub-fusiformi, costellatá, concentrice lineatá: spirá elevatá, conoideá: anfractibus convexiusculis, antice valde coarctatis; postice unico sulco exaratis, ad suturam tuberculatis; costellis arcuatis, per-brevibus; aperturá ovali, in canali brevi, latiusculo, exeunti; labro arcuato, intús dentato; sinu sub-trigono, profundo, in margine collocato.

Shell elongate, fusiform, ornamented with longitudinal ribs and sharp, concentric, raised lines: the spire, which is composed of seven or eight whorls, is rather conical, pointed, and elevated, forming almost two thirds of the whole length of the shell. The whorls are slightly convex, and suddenly much contracted towards the middle, so as to be almost angulated; a deep concentric furrow runs round the posterior margin, the sutural edge of which is thickened and presents a single row of round or oblong tubercles, varying in size in different specimens: the ribs are arched, sharp, and rarely extend beyond the middle of the whorl. The aperture is oval and terminates anteriorly in a short, wide canal; the outer lip is arched, sharp-edged, and armed within with two or three teeth, the largest of which is placed immediately in front of the sinus; the sinus itself is deep, sub-trigonal, and wide, occupying the whole breadth of the margin.

This *Pleurotoma* is smaller and narrower than *P. innexa*, to which it bears some resemblance; but the contracted whorls and short ribs distinguish it from that species.

Size.—Axis, rather more than 5-12ths of an inch; diameter, 2-12ths of an inch.

Locality.—Higheliff, where it is not uncommon.

No. 166. *PLEUROTOMA MICROCHEILA*. *F. E. Edwards*. Tab. XXVIII, fig. 8, *a—f*.

P. testá parvâ, crassâ, fusiformi, nodulosâ: spirá obtusâ: anfractibus convexiusculis, ad humeros sub-angulatis; marginibus posticis canaliculatis, ad suturam unicâ serie tuberculorum ornatis; ultimo anfractu costellas angustas et lineas concentricas acutas, sese decussantes, gerenti; aperturâ elongato-ovali, in canali per-brevi terminanti; labro leviter arcuato, acuto, intús incrassato, plicifero; sinu lato, sub-profundo, sub-trigono, antice in margine collocato.

Var. PRODUCTA, *testá angustiori; spirá elevatiori; lineis spiralibus eminentioribus.*

Shell small, thick, fusiform, and having the whole surface ornamented with concentric rows of round, knob-like tubercles: the spire, which equals the last whorl in length, is obtuse and pointed: the whorls, six or seven in number, exclusive of the

pullus, are slightly convex and angulated at the shoulders; the posterior margins rather wide, deeply channelled, and bordered by a series of closely-set, knob-like tubercles; the shoulders present a single row of oblong tubercles, divided by a concentric sulcus, and from these tubercles arise narrow, curved costellæ, which extend almost to the very front of the whorl, and are decussated by sharp, concentric, raised lines, not quite so prominent as the costellæ, forming small tubercles at the points of decussation; the costellæ and concentric lines, in the earlier whorls, are nearly concealed by the succeeding whorl, and are only perfectly seen on the body-whorl. The aperture is of an oblong-oval form, terminating in a wide, short canal; the outer lip is but slightly arched, sharp on the edge, and thickened and strongly plicated within; the sinus, which is placed in front of the margin, is wide, rather deep, and sub-trigonal in shape. A variety occurs in which the shell is narrower, the spire relatively longer, and the concentric lines more prominent.

This seems to be a well-marked species, of which I have not been able to find a foreign representative.

Size.—Axis, 4-12ths of an inch; diameter, 2-12ths of an inch.

Localities.—Highcliff, where it is found rather abundantly, Alum Bay (No. 29, Prestwich), Barton.

No. 167. *PLEUROTOMA DISSIMILIS*. *F. E. Edwards*. Tab. XXVIII, fig. 7, *a—c*.

P. testá parvá, crassá, rugose costatá, omnino concentrice lineatá: spirá brevi, obtusá, nodulosá: anfractibus convexiusculis, ad humeros sub-carinatis, postice sulco profundo spiraliter exaratis, marginatis; costis brevibus, latis, rotundatis; lineis concentricis plus minusve numerosis, per-elevatis, denticulatis: aperturá oblongo-ovali, in canali brevi, latiusculo exeunti; labro sub-recto, acuto, intus unicam plicam dentiformem gerenti; labio angustissimo; sinu lato, profundo, trigono, in margine collocato.

Shell small, thick, coarsely ribbed, concentrically lined: the spire wide and rather short, being less than two fifths of the whole length of the shell: the whorls rather convex, slightly carinated at the shoulders, and bordered round the sutural margin by a sharp, elevated, ridge-like line, the space between which and the shoulder is traversed by a deep, round furrow, in which two or three feeble concentric lines are seen. The ribs are few in number, very short, broad, rounded, and separated by narrow furrows; they become nearly obsolete, and frequently altogether lost on the last whorl; the concentric lines are sharp, much elevated, more or less numerous in different specimens, and generally denticulated by the lines of growth. The broad, short, posterior terminations of the ribs, left exposed by the overlapping of the succeeding whorls, resemble tubercles, and give a coarsely nodulous character to

the spire. The aperture is of an oblong-ovate form, and terminates anteriorly in a short, but distinct and moderately wide, canal; the outer lip is very slightly arched, nearly straight, sharp-edged, and presents within, near the posterior extremity, and immediately under the shoulder, a single large, tooth-shaped callosity; the inner lip is very narrow, barely extending to the front of the columella; the sinus is nearly triangular in form, deep and wide, extending across the whole of the posterior margin.

Size.—Axis, 3·4-12ths of an inch; diameter, 1·75-12ths of an inch.

Localities.—Highcliff, where it is not uncommon; Haverstock Hill.

No. 168. PLEUROTOMA GOMPHOIDEA. *F. E. Edwards*. Tab. XXVIII, fig. 13, *a—f*.

P. testá angustá, elongatá, sub-turritá, longitudinaliter costatá, concentrice lineatá: spirá acuminatá, elevatá: anfractibus depresso-convexis, ad humeros sub-angulatis; marginibus posticis latiusculis, concavis, ad suturam distanter granulatis; ultimo anfractu brevi, antice coarctato; costellis curvis, brevibus, plus minusve numerosis; lineis concentricis, supra margines fere obsoletis, cæterum elevatis, acutis, sæpe denticulatis: aperturá oblongo-ovali, in canali brevi, sub-recto creanti; labro sub-aliformi, acuto, sinu lato, minime profundo, in margine collocato.

Var. AVITA, testá anfractibus unicá serie tuberculorum coronatis.

A long, narrow, turriculate shell, ribbed, and concentrically lined: the spire, which forms two thirds of the whole shell, consists of seven or eight volutions: the whorls are flatly convex on the sides, angulated at the shoulders, contracting rather suddenly in front, and having the posterior margins widely channelled and bordered on the sutural edge by a single row of round, rather distant granules, corresponding with the ribs, and variable in size; the angulated shoulders and channelled margins give a turriculate character to the spire. The longitudinal ribs are more or less numerous in different specimens; they are curved, sharp, and terminate abruptly where the whorl contracts; the concentric lines over the posterior margins are close-set, and so fine as to be barely visible to the naked eye; over the middle and front parts of the whorl they are moderately distant, elevated, sharp, and generally denticulated where they cross the ribs. The aperture is of an oblong-oval shape, and terminates in a wide, short, but distinct and nearly straight canal; the outer lip is expanded anteriorly, sharp-edged, and smooth within; and the sinus, which is wide, rather shallow, and rounded, is placed in the margin.

I possess specimens both from Clarendon and Southampton, in which the ribs are wanting, and the whorls are girt round the shoulders with a single row of knob-like tubercles; in all other respects these shells agree with the typical *P. gomphoidea*, of which, therefore, I consider them to be a variety.

Size.—Axis, rather less than half an inch ; diameter, not quite 2-12ths of an inch.

Localities.—Barton, Highcliff, Alum Bay (No. 29, Prestwich). *For the variety*: Clarendon and Southampton.

No. 169. *PLEUROTOMA PLICATA*. *Lamk.* Tab. XXVIII, fig. 11, *a—c*.

PLEUROTOMA PLICATA. *Lamk.* 1804. Ann. du Mus., vol. iii, p. 169, No. 14.

— — *Lamk.* 1822. Hist. natur., &c., vol. vii, p. 100, No. 19.

— — *Desh.* 1824-37. Descr. des Coq. foss., &c., vol. ii, p. 487, t. 66, figs. 17—19.

Nec — — *Bast.* 1825. Mem. Géol. sur les Env. de Bord., p. 64, No. 6.

nec — — *Des Moul.* 1834. (Dufrén. Terr. tert., &c., du Midi de la France.)
Ann. des Mines, 3d series, vol. iii, p. 122.

nec — — *Phil.* 1836. Enum. Moll. Sicil., p. 198, No. 5.

nec — — *Grat.* 1847. Conchyl. foss., &c., du bass. de l'Adour (Atlas);
Pleurot., t. 2, No. 20, fig. 36.

P. testá crassá, elongato-fusiformi, angustá, longitudinaliter costatá, omnino concentrice lineatá: spirá mediocriter elatá, sub-acuminatá: anfractibus convexis, suturá perspicuá divisís; costis rotundatis, obliquis, arcuatis, distantibus; lineis concentricis filiformibus, regularibus: aperturá angustá, ovali, in canali brevi cæcanti; labro acuto, intus incrassato postice, prope sinum, callum nodiformem gerente; sinu lato, profundo, sub-trigono, in margine collocato.

Shell thick, elongated, fusiform, rather narrow, longitudinally ribbed, and having the whole surface covered with concentric, raised lines; the spire, which consists of six or seven volutions, exclusive of the pullus, is moderately elevated, forming nearly one half of the whole length of the shell; the whorls convex, and separated by a perspicuous suture. The longitudinal ribs are prominent, rounded, oblique, slightly curved, distant, numbering only six or seven on each whorl, and becoming nearly obsolete on the body-whorl; the intermediate spaces are nearly flat, imparting a polygonal aspect to the spire; the concentric lines are rather numerous, elevated, rounded, clearly defined, and regular, giving to the shell the appearance of being bound with thread; the two or three lines over the shoulder are, in general, more distant, and a very little more prominent, than the others. The aperture is of a narrow, oval form, and terminates in a wide, short canal; the outer lip is moderately arched, sharp on the edge, much thickened within, where it presents a long, rather broad, and elevated ridge, extending quite into the canal, and terminating behind, immediately in front of the sinus, in a round, knob-like callus; the sinus is broad, deep, somewhat triangular in shape, and placed in the margin.

The English shells present several points of disagreement with those from the

Calcaire grossier, and may be regarded by some, perhaps not unreasonably, as specifically distinct rather than as constituting a local variety. Thus, in the French shells, the posterior margins of the whorls are so feebly lined that to the naked eye they appear to be smooth; the ribs are more numerous, narrower, and less prominent; the concentric lines are rather more crowded and more feeble, becoming nearly obsolete; and the shells themselves are thinner. It appears to me, however, that these variations can scarcely be regarded as of specific value; while in the relative proportions, the general character of the ornamentation, the condition of the outer lip, particularly the characteristic callus, and the shape and position of the sinus, the French and English shells correspond. On the whole, therefore, I am inclined to regard the English shells as forming merely a coarse, strongly marked variety of the French species.

The shells from Dax and Bordeaux, referred to this species by Basterot and Grateloup, appear to be distinct, and Desmoulins has separated them under the name *P. variabilis*. According to Bronn, they correspond with certain Pleurotomoid shells previously separated by Millet as *Defrancia variabilis*.

Size.—Axis, 8-12ths of an inch (17 millim.); diameter, 3-12ths of an inch ($6\frac{1}{2}$ millim.)

Localities.—Bramshaw, Brook. *French*: Grignon, Parnes, Mouchy, Courtagnon (fide Desh.), Halaincourt (fide Graves).

No. 170. *PLEUROTOMA ACUTICOSTA*. *Nyst.*? Tab. XXVIII, fig. 14, *a—c*.

PLEUROTOMA ACUTICOSTA. *Nyst.*? 1843. Coq., &c., foss. de Belg., p. 529, No: 454, tab. 42, fig. 5.

— — *Morris*. 1854. Cat. Brit. Foss., 2d edit., p. 269.

P. testá elongato-fusiformi, longitudinaliter costellatá, concentrice lineatá: spirá elevatá, acuminatá: anfractibus convexiusculis, postice depressis, sub-canaliculatis; ultimo anfractu antice coarctato, in canali brevi, indistincto, latiusculo terminanti; costellis obliquis, angustis, sub-distantibus; lineis concentricis exilibus, numerosis: aperturá ovatá; labro leviter arcuato acuto; sinu lato, sub-semicirculari, in margine collocato.

Shell oblong, fusiform, longitudinally ribbed, concentrically lined; spire pointed, much produced, nearly equalling three fifths of the entire length of the shell; whorls, eight or nine, slightly convex; the posterior margins somewhat depressed and furrowed; the last whorl contracted in front and forming a wide, short, and indistinct canal. The longitudinal ribs are narrow, rather distant, rounded on the upper surface, and slightly oblique; the concentric lines very slender, irregular, close-set, becoming obsolete over the posterior margins. The aperture is of an oblong-oval

form; the outer lip a little arched, thin, sharp-edged, and smooth within; the sinus wide and nearly semicircular, and placed in the posterior margin.

The figure of *P. acuticosta* in M. Nyst's work is, unfortunately, so indistinct that it affords but little assistance towards an identification. The English shell, however, agrees tolerably well with the description given by that author, and I have referred it to M. Nyst's species, although with hesitation, as I have not had an opportunity of comparing it with any Belgian specimen.

The English shells which the present *Pleurotoma* most nearly resembles, are those referred to *P. plicata* (Lamk.); but this species differs from them in the more slender form of the shell, the more depressed margins of the whorls, the narrower, more numerous, and more regular costæ, and the finer transverse lineation; and, in the specimen I possess, the outer lip is not thickened within, nor does it present the callus which characterises *P. plicata*.

The species appears to be very rare.

Size.—Axis, $\frac{1}{2}$ inch; diameter, rather more than 2-12ths of an inch.

Localities.—Barton. *Belgian*: Gremittingen (Lower Limburg series).

No. 171. *PLEUROTOMA TERETICOSTA*. *F. E. Edwards*. Tab. XXIX, fig. 5, *a—d*.

P. testâ fusiformi, sub-turritâ, costellatâ, spiraliter fasciolatâ: spirâ obtusiusculâ, elevatâ, in longitudine aperturam æquanti: anfractibus depresso-convexis, ad humeros sub-angulatis, postice sulco profundo exaratis, marginatis; ultimo anfractu antice coarctato, in canalem brevem latum producto; costellis numerosis, leviter arcuatis, rotundatis, brevibus; fasciis spiralibus crebris, irregularibus, alternatim latiusculis et angustioribus; fasciis anterioribus elevatis, cæteris fere obsoletis: sinu lato, minime profundo, triangulari, in margine collocato.

Var. SOROR, testâ spiraliter sulcatâ; canali antico breviori.

Shell fusiform, longitudinally ribbed, and spirally girt with ribbon-like bands: the spire is thickish and moderately elevated, not exceeding the aperture in length: the whorls, five or six in number without the pullus, are rather flat-sided and bluntly angulated at the shoulders; the posterior margins narrow, deeply furrowed, and much thickened at the edges, where they present a moderately wide band running round the suture. The longitudinal ribs are numerous (twelve to fourteen), slightly curved, round and smooth on the upper surface, short, not extending beyond the middle of the whorl, tapering towards the front, and occasionally bifurcated; the posterior extremities are continued over the shoulder up to the sutural band; the spiral bands are numerous and irregular, ribbon-like bands alternating with other narrower bands; over the anterior canal and the front part of the whorl up to the termination of the ribs, these bands are elevated and distinct; elsewhere they are nearly obsolete. The body-whorl contracts rather suddenly about the middle,

and thence tapers gradually towards the front, so as to form a wide and short, but distinct, canal; the aperture is of a compressed-oval shape; and the sinus, which is placed in the marginal furrow, is wide, shallow, and triangular in form.

The general resemblance between the present species and *P. turgidula* might suggest the propriety of uniting the two; but, on a careful examination, differences will be found which seem to justify their separation. Thus, in the present species, the spire is more obtuse; the whorls more contracted in front; the posterior margins deeply furrowed and bordered at the suture by a broad, thick band; the longitudinal ribs are more numerous, more decided in character, and less oblique; and the sinus is shallower and more pointed.

A specimen in my cabinet, obtained from the Artesian well at Southampton, has the surface of the shell spirally furrowed instead of banded, and the anterior canal a little shorter and wider. These differences, however, do not appear to be sufficiently important for specific distinction, and I have therefore regarded the shell in question as a variety of the present species.

Size.—Axis, 6-12ths of an inch; diameter, rather more than 2-12ths of an inch.

Localities.—Highgate, Southampton.

NO. 172. *PLEUROTOMA TURGIDULA*. *F. E. Edwards*. Tab. XXIX, fig. 4, *a—c*.

P. testá fusiformi, sub-turritá, spiraliter sulcatá, costellatá: anfractibus sub-ventricosis, ad humeros angulatis, postice declivis vix cavatis, ad suturas unicá serie granularum instructis; sulcis spiralibus irregularibus, minime profundis, fere obsoletis; costellis obliquis, angustis: aperturá ovali, antice in canali breviusculo cavanti; labro arcuato; sinu sub-trigono, latiusculo, mediá in margine collocato.

Shell fusiform, sub-turreted, concentrically furrowed, and longitudinally ribbed; the spire, formed of six volutions exclusive of the pullus, is moderately elevated, forming rather less than half of the shell: the whorls are roundedly convex, almost ventricose, and bluntly angulated at the shoulders; the posterior margins, which slope gently backwards, are nearly straight, and the sutural edge is girt by a single row of small, round tubercles. The concentric furrows are numerous, irregular, and almost obsolete over the posterior margins and middle of the whorls, but a little deeper and more perspicuous over the front; the longitudinal ribs are rather numerous, narrow, oblique, and very short, barely extending to the middle of the whorl, and slightly swelled at the posterior extremities; on the last whorl the ribs become reduced to small and not very prominent tubercles. The aperture is oval, and terminates in front in a short, but distinct and moderately wide, canal; the outer lip is slightly arched; the sinus, placed in the very middle of the posterior margin, is wide, rather shallow, and somewhat triangular in form.

Size.—Axis, 8-12ths of an inch ; diameter, 3-12ths of an inch.

Locality.—Alum Bay (Stratum No. 29, Prestwich ?) ; rare.

No. 173. *PLEUROTOMA DILINUM*. *F. E. Edwards*. Tab. XXVIII, fig. 15, *a, b*.

P. testá minimá, oblongá, fusiformi, granulátá, concentrice lineatá: spirá obtusiusculá, sub-conicá: anfractibus sub-convexis, duplici serie granulorum coronatis, spatio inter series concavo, lævi; ultimo anfractu antice valde coarctato, in canalem latissimum, brevem, reflexum producto; lineis spiralibus, acutis, sub-distantibus: aperturá ovali; labro acuto, leviter arcuato, intús plicato; sinu latissimo, mediocriter profundo, sub-trigono, anticá in margine collocato.

Shell very small, oblong, fusiform, spirally girt by a double row of small, bead-like tubercles, concentrically lined; spire rather thick, nearly conical; whorls slightly convex; the posterior margins concave, smooth, bordered in front and behind by the rows of tubercles; the last whorl much contracted in front, and terminating in a very wide, short, but distinct, canal, a little bent backwards; the concentric lines thin, sharp, and rather distant. The aperture is of an oval form; the outer lip slightly arched, expanding towards the front, sharp-edged, and plicated within; the sinus very wide, moderately deep, somewhat triangular in shape, and placed in the front part of the posterior margin.

This *Pleurotoma* is allied to *P. microcheila*, the var. *producta* of which closely resembles it; but the wide posterior margins, the greater regularity of the granulations, and the broad anterior canal, distinguish the present species.

Size.—Axis, not quite 3-12ths of an inch ; diameter, 1-12th of an inch.

Locality.—Alum Bay (No. 29, Prestwich).

No. 174. *PLEUROTOMA TRICINCTA*. *F. E. Edwards*. Tab. XXVIII, fig. 6, *a, b*.

P. testá parvá, elongato-fusiformi, sub-turritá, spiraliter lineatá: spirá acuminatá, breviusculá, aperturam in longitudine vix æquantí: anfractibus depresso-convexis; postice profunde canaliculatis, marginatis; ultimo anfractu in canalem brevem, latum, producto; lineis spiralibus exilibus, filiformibus, irregularibus, sub-clathratis: aperturá oblongo-ovali; labro arcuato; sinu lato, mediocriter profundo, in margine collocato.

Shell small, oblong, fusiform, indistinctly turreted, concentrically lined; spire pointed, rather short, not equalling the last whorl in length; whorls flatly convex at the sides; the posterior margins deeply hollowed, giving the turreted aspect to the spire, and ornamented with a series of roundedly curved plications, formed by the successive elevated margins of the sinus; the sutural edge is bordered by a sharp, ridge-like, raised line; the last whorl is contracted in front, and terminates in a very

wide, short, indistinct canal. The spiral lines are slender, thread-like and irregular, others, finer still, occasionally intervening; all are much roughened, almost decussated, by the prominent lines of growth; from the upper three lines, left uncovered by the succeeding whorl, the specific name is taken. The aperture is of a narrow, oval form; the outer lip roundedly arched, thin, sharp-edged, and smooth within; and the sinus, which extends over the whole breadth of the margin, is wide, rather deep, and somewhat triangular in form.

The only two specimens I have seen of this rare *Pleurotoma* do not appear to have attained their full growth; the characters, however, are sufficiently distinct to justify the present notice.

Size.—Axis, 4-12ths of an inch, nearly; diameter, 1-8th of an inch.

Locality.—Potter's Bar.

NO. 175. *PLEUROTOMA PUPA*. *F. E. Edwards*. Tab. XXVIII, fig. 9, *a—c*.

*P. testá elongato-fusiformi, longitudinaliter plicatá, concentrice lineatá: spirá obtusi-
usculá, sub-conicá: anfractibus convexiusculis; postice plicatis, unico sulco angusto exaratis,
ad suturam aliquando lineá elevatá filiformi cinctis, aliquando granulatis; costellis crebris
angustis, arcuatis, in ultimo anfractu obsoletis; lineis concentricis acutis, plus minusve
numerosis, costellas decussantibus: aperturá angustá, ovali, in canali brevi, obliquo
exeunti; labro leviter arcuato, intús plicato; sinu sub-trigono, profundo, in margine
collocato.*

Var. a, testá graciliori; spirá acutiori.

Shell oblong, fusiform, with an elevated, somewhat obtuse, and nearly conical spire, forming one half of the entire shell; whorls six or seven, slightly convex, longitudinally plicated, concentrically lined, and separated by a conspicuous suture; the posterior margins are thickened round the sutural edge, and present a narrow, concentric furrow, corresponding with the smaller extremity of the sinus, and finely plicated; the narrow space between this furrow and the suture is girt by a thickish, elevated, thread-like line, generally simple, but sometimes—more especially in the early whorls—decussated by the successive margins of the sinus, so as to present a row of rather coarse granulations. The longitudinal plications are numerous, and curved; they are slightly prominent on the shoulder, but become attenuated as they pass over the middle of the whorl, and are frequently altogether lost on the last whorl of the mature shell. The concentric lines are prominent, sharp, more or less distant in different specimens, and feebly denticulated, where they cross the longitudinal plications. The aperture is of a narrowish, oval form, and terminates in front in a short, but distinct and moderately wide, canal, to which the twisted columella gives an oblique direction; the outer lip is slightly arched, thin, and sharp

on the edge, and frequently, but not invariably, armed within with three or four pliciform teeth; the sinus is deep, three-cornered, and placed in the margin.

A variety occurs in which the shell is slenderer, and the spire more pointed.

Size.—Axis, 6-12ths of an inch; diameter, rather more than 2-12ths of an inch.

Localities.—Barton, Highcliff, for the type; Bramshaw and Alum Bay (Stratum No. 4, Prestwich), for the variety.

No. 176. *PLEUROTOMA SCABRIUSCULA*. *F. E. Edwards*. Tab. XXIX, fig. 2, *a—c*.

PLEUROTOMA DECUSSATA, *Lamk.*? 1804. *Ann. du Mus.*, vol. iii, p. 267, No. 25.

P. testá sub-turritá, tuberculatá, omnino concentrice lineatá: spirá obtusiusculá, elatá, in longitudine dimidium totius testæ superanti: anfractibus convexis, antice coarctatis, ad humeros sub-angulatis, unicâ serie tuberculorum instructis; marginibus posticis declivis, rix cavatis, granulato-marginatis; lineis concentricis elevatis, sub-distantibus, simplicibus vel leviter denticulatis: aperturâ obovatâ, in canali lato, brevi terminatâ; labro arcuato, acuto, intus plicato; sinu lato, profundo, sub-trigono, mediâ in margine collocato.

Var. a, testâ tuberculis verticaliter productis, costellas simulantibus.

Shell turriculated, tuberculated, and ornamented with concentric, raised lines, which cover the whole surface: the spire, consisting of six or seven volutions, is rather thick and elevated, forming a little more than one half of the entire shell. The whorls are convex, slightly contracted in front, and bluntly angulated at the shoulders, where they present a single row of small, oblong tubercles, more or less distant in different individuals, and crossed by the concentric lines, two of which are generally more prominent than the rest; the posterior margins are moderately wide, gently depressed, very slightly concave, and thickened and granulated round the sutural edge. The concentric lines are prominent, sharp, and not very distant, varying in this respect in different specimens; they are generally simple and smooth on the edge, but sometimes denticulated by the strongly marked lines of growth. The aperture is of a broadish, oval shape, and terminates anteriorly in a wide and short, but distinct, canal; the outer lip is much arched, sharp-edged, and plicated within; the sinus is wide, deep, somewhat triangular in form, and placed in the middle of the margin.

A variety occurs, rather plentifully, in which the spire is more pointed, and the tubercles on the shoulders of the whorls are lengthened both in front and behind, so as to form short, narrow ribs.

This shell presents so close a resemblance to *P. decussata* (Lamk.), that I am reluctant to consider the two as specifically distinct. The French shell is generally narrower, and the body-whorl is less contracted in front and more conical than in the English specimens; and M. Deshayes describes it as being much shorter than the spire; but in a series of French specimens, for which I am indebted to the liberality

of that gentleman, the spire forms, in a majority of instances, very little more than half of the length of the shell, and the diameter, in some individuals, is relatively greater than that of the English shells. The tubercles are larger and coarser in the French shells, and the plication within the outer lip is found in them, although that character is not noticed by M. Deshayes.

The chief distinctions between the English and French shells appear to lie in the more conical form of the whorls and the coarser tuberculation in the latter; but these distinctions give very different aspects to the shells, and I have not ventured absolutely to refer the English shells to the French species, although they may perhaps be fairly regarded as forming a local variety.

Size.—Axis, rather more than 5-12ths of an inch (11 millim.); diameter, rather more than 2-12ths of an inch (5 millim.).

Localities.—Highcliff (where it is rather abundant) and Barton.

No. 177. *PLEUROTOMA VERTICILLUM*. *F. E. Edwards*. Tab. XXIX, fig 3, *a—c*.

P. testá turriculatá, longitudinaliter costellatá, omnino concentrice lineatá: spirá elatá, acuminatá: anfractibus planulatis, ad humeros angulatis, antice coarctatis; marginibus posticis depressis, sub-rectis, vix cavatis, obscure lineatis, ad suturam granulatis; ultimo anfractu in canali brevi terminanti; costellis crebris, arcuatis, acutis, fere ad basin tendentibus; lineis concentricis irregularibus, acutis, denticulatis: aperturá orali; labro arcuato, acuto, intús plicato; sinu profundo, sub-trigono, anticá in margine collocato.

Var. testá costellis brevioribus, tuberculiformibus, ultimo anfractu obsoletis.

Shell turriculate, longitudinally ribbed, concentrically lined: spire pointed, elevated, considerably exceeding the aperture in length; whorls, eight or nine, flat-sided, slightly angulated at the shoulders, and much contracted in front; the posterior margins depressed, very slightly channeled, nearly straight, and most generally bordered round the sutural edge by a row of small tubercles. The longitudinal ribs are numerous, thin, sharp, and obliquely curved, and extend almost to the very front of the shell; the concentric lines are elevated and sharp, and cover the whole surface of the shell; over the margins of the whorls they are moderately close and regular; but over the middle and front parts of the whorls they become more elevated, more distant, and somewhat irregular, very fine lines occasionally intervening between the more prominent ones; these concentric lines strongly decussate the longitudinal ribs, rising into small, sharp tubercles at the points of decussation. The aperture is rather widely oval, and terminates anteriorly in a short, but distinct, canal; the outer lip is arched, and somewhat dilated in front; the inner lip narrow, but thick and prominent; and the sinus, which is three-cornered in shape, deep, and wide, is placed in the front part of the margin.

Occasionally specimens occur in which the longitudinal ribs are lost on the last

whorl, and are much shortened on the earlier whorls, assuming the appearance of oblong tubercles; and the decussation by the concentric lines disappears.

The present species presents a close analogy with *P. scabriuscula*, with which it may, especially in the young state, be readily confounded. On comparing adult shells, however, it will be found that, in this species, the shell is wider, the spire more pointed, the whorls less bluntly angulated at the shoulders, and more depressed and more deeply channeled round the margin, giving a decidedly turreted character to the spire; the whorls themselves are more numerous and shorter, and, in the typical form, the sharp ribs and prominent concentric lines give a rougher aspect to the surface. In the varieties a somewhat closer approximation will be found in the ornamentation of the two species; but, in other respects, the characteristic distinctions are preserved.

From *P. constricta*, the only other species with which it might be confounded, it is separated by the depressed margins, and more sharply angulated shoulders of the whorls, the more regular costellation, and the deep, narrow sinus of that species.

Size.—Axis, rather more than 8-12ths of an inch; diameter, 3-12ths of an inch.

Localities.—Barton, Highcliff; not common.

NO. 178. *PLEUROTOMA CONSTRICTA*. *F. E. Edwards*. Tab. XXIX, fig. 1, *a—c*.

P. testá elongato-fusiformi, longitudinaliter costellatá, concentrice lineatá: spirá conoideá, sub-acuminatá, aperturam in longitudine paullo superanti: anfractibus depresso-convexis, ultimo anfractu in canali brevi, terminanti; marginibus posticis leviter declivis, canaliculatis, plicatis, ad suturam marginatis; costellis crebris, angustis, obliquis; lineis concentricis, acutis, denticulatis: aperturá oblongo-ovali; labro leviter arcuato; sinu angusto, profundo, trigono, anticá in margine collocato.

Shell elongated, fusiform, longitudinally ribbed, and concentrically lined; the spire, formed of seven or eight whorls, is rather conical, pointed, and moderately elevated, barely exceeding the body-whorl in length; whorls flatly convex; the posterior margins widely and deeply channeled, thickened at the sutural edges, and bordered by a single sharp, prominently raised line; the surface of the marginal furrow presents a series of prominent, curved plications, formed by the successive margins of the advancing sinus. The longitudinal ribs are numerous, slender, oblique, slightly curved, and extend almost to the very front of the whorl; the concentric lines are sharp, prominent, more or less distant in different individuals, and denticulated at the points where they cross the ribs. The aperture is of an oblong-oval form, and terminates in front in a short, moderately wide, canal; the outer lip is but slightly arched, thin, sharp-edged, and smooth within; the sinus is trigonal, narrow, very deep, and placed in the front part of the margin.

The present species much resembles *P. innexa*, with which, in fact, at first sight, it may be easily confounded; on a closer inspection, however, differences will be detected which render it impossible to regard it as even a strongly-marked variety of *P. innexa*. In the general form, *P. constricta* is a slenderer shell, with a more pointed spire, and, instead of the shallow, obscure furrow, bordered by a row of granulations which runs round the posterior margins of the whorls in *P. innexa*, the present species presents a wide, conspicuous channel, defined by a sharp, elevated ridge; the outer lip is much less arched, and is not thickened or plicated within, and the sinus is deep, narrow, three-cornered, and placed in the front part of the margin, instead of the wide, rounded sinus extending over the whole width of the margin which characterises *P. innexa*.

Size.—Axis, rather more than 8-12ths of an inch; diameter, 3-12ths of an inch.

Localities.—Barton, Highcliff, Highgate.

No. 179. PLEUROTOMA PYRGOTA. *F. E. Edwards*. Tab. XXVIII, fig. 16, *a—c*.

P. testá sub-fusiformi, turrítá, longitudinaliter obscure costulatá, concentrice sulcatá: anfractibus ad humeros carinatis, antice planulatis, sub-conicis, postice canaliculatis, transversim lineatis, crenato-marginatis; costellis antice bifurcatis, sub-obsolete: aperturá oblongo-ovali, in canali brevi exeunti; labro intús plicifero; sinu lato, sub-semicirculari, in margine collocato.

Var. a. Testá costellis distinctioribus, productionibus: anfractibus antice granoso-lineatis, cæterúm lævibus.

Shell sub-fusiform, turreted, longitudinally ribbed, and concentrically furrowed: the spire, which consists of seven or eight volutions, exclusive of the smooth, conical pullus, is moderately elevated, forming about one half of the entire shell; the whorls flat-sided, giving a nearly conical aspect to the anterior part of the shell, sharply carinated at the shoulders, and having the posterior margins channelled and bordered round the suture by a sharp, elevated line, simple or feebly crenulated, the concave space between which and the shoulder is smooth; the keel on the shoulders is notched with much regularity, presenting a row of oblong, somewhat oblique, rib-like tubercles. These tubercles are prolonged anteriorly, and bifurcate, forming two curved, narrow, obscure ribs, which are lost as they cross the middle of the whorls; the concentric furrows are shallow and wide, the intervening spaces becoming gradually more elevated and sharper as they approach the base of the shell. The aperture is of a narrow, elongated, oval form, and terminates in front in a short, wide canal; the outer lip is slightly arched, somewhat thickened and plicated within; and the sinus, which extends over the whole margin, is wide and deep, and nearly semicircular.

Specimens occur, constituting a local variety, in which the ribs are more distant and prominent, and extend to the very front of the shell; four or five distant, elevated, concentric lines cross the whorl over the anterior canal, and are granulated at the points where they are intersected by the lengthened ribs; elsewhere the whorls are smooth.

A miocene shell, described by Brocchi (*Murex reticulatus*—*Pleur. ramosa*, Bast.), presents a very close analogy with this *Pleurotoma*, as well in the general shape as in the character of the ornamentation; it is distinguishable, however, by the greater size of the shell, which attains a length of nearly three inches, the greater narrowness and the simple margins of the whorls, the relatively longer spire and shorter aperture, the shape and position of the sinus, and the condition of the outer lip, which is smooth within. A *Pleurotoma* also occurs in the nummulitic beds near Pau, described by Rouault (*Pleur. Tallavignesi*), to which I have referred some shells from Nuneham and Southend, and which, in the young state particularly, much resembles the present species; but in that shell the whorls are more contracted in front; the posterior margins spirally lined, wider, and not so depressed; the longitudinal plications are more oblique, the lineation finer and more close; the anterior canal longer; the outer lip more arched; and the sinus not so deep.

Size.—Axis, 10-12ths of an inch nearly; diameter, rather more than 3-12ths of an inch.

Localities.—Bramshaw, for the type; Brockenhurst, for the variety.

No. 180. *PLEUROTOMA BREVIROSTRUM*. Sow. Tab. XXIX, fig. 6, *a*, *b*.

			PLEUROTOMA BREVIROSTRUM. Sow. 1823. Min. Con., vol. iv, p. 120, t. 387, fig. 2.
	—	—	Bronn. 1848. Index Palæont., p. 1002.
	—	—	D'Orb. 1852. Prodrome de Paléont., 25 ^e Etage, No. 411.
Nec	PLEUROTOMA BREVIROSTRUM.	Sism.	1847. Syn. Meth. Anim. Invert. Pedem. foss., p. 32.
nec	—	—	Bell. 1847. Pleurot. Foss. del Piem. (Mem. R. Accad. delle Sc. di Torino), p. 607, t. 4, fig. 9.
nec	—	—	Naumann. 1853. Atlas zu sein. Lehrb. der Geogn., t. 70, fig. 4.

P. testá elongatá, angustá, turritá, longitudinaliter nodo-costatá, concentrice lineatá: spirá elevatá, acuminatá: anfractibus medio angulatis; marginibus posticis latis, declivis, rix cavatis, sub-levibus, ad suturam incrassatis; ultimo anfractu brevi, antice coarctato; costis crassiusculis, brevibus; lineis concentricis filiformibus, sub-regularibus: aperturá obovatá, in canali brevi, mediocriter lato, leviter arcuato et retrorsum reflexo exeunti; sinu lato, profundo, subtrigono, mediá in margine collocato.

Shell narrow, elongate, turreted, longitudinally ribbed, and spirally lined: the spire, which consists of nine volutions exclusive of the pullus, is pointed and much elevated, forming nearly two thirds of the entire shell. The whorls are sharply

angulated at the shoulders, to which the last but one of the concentric lines, more prominent than the others, gives the appearance of being carinated. By this keel-like line, the whorl is nearly equally divided; the anterior half, covered with the concentric lines, is flat-sided; the posterior half, forming the margin of the whorl, is very slightly channelled, almost straight, and smooth, except where it presents obscure curved lines, indicating the earlier outlines of the sinus, and is bordered round the suture by a single coarsish, thread-like, raised line. The posterior margins slope backwards, at an angle with the shoulders corresponding with that formed by the anterior portion of the whorl, giving a regular zig-zag outline to the spire. The ribs are moderately distant, not very broad, rounded, and short, barely extending to the middle of the whorls; the concentric lines are thread-like, rather thick, and separated by concave furrows as wide as the lines; excepting the one on the shoulders, they are nearly equal and regular. The aperture, which is of a widish-oval shape, terminates in front in a short, slightly oblique, and not very wide canal, the anterior extremity of which is a little bent backwards; the outer lip, as indicated by the lines of growth, is arched; and the sinus, which extends over the whole width of the margin, is deep and subtrigonal in shape.

The wide, straight margins, angular shoulders, and zig-zag outline of the whorls, which characterise this species, are not noticed in the description, nor represented in the figure given in the 'Mineral Conchology.' The present *Pleurotoma*, as described and figured in that work, would appear to resemble a well-known Miocene species (*Murex oblongus*, Brocchi, the *Pleurotoma dubia*, Jan.; *P. obeliscus*, Des Moul.; and *P. multinoda*, Grat.); and this, probably, has misled Bellardi and other continental authors into referring the Miocene shells to *P. brevirostrum*. In these shells, however, the posterior margins of the whorls are narrow and concave, the sides nearly parallel with the axis, the ribs long, extending to the front of the whorls, and the anterior canal is very short and wide. *P. brevirostrum*, in fact, more nearly resembles *P. Lamarcki*, Bell (*P. semistriata* of Partsch), a species described by Hörnes as occurring in the Tertiary Beds of Germany; and it agrees so closely with some Miocene shells, from the neighbourhood of Vienna, in the British Museum, that the latter cannot be regarded as specifically distinct. These shells have been, I think incorrectly, referred to *P. oblonga*; they are smaller and narrower than *P. Lamarcki*, and the margins of the whorls are not quite so concave, but they may be, probably, a variety of that species.

The shell on which the present species was founded, and for the use of which I am indebted to Mr. Sowerby, was presented to the late Mr. Sowerby by Lady Burgoyne, by whom it was stated to have been found at Muddiford; I do not know of any other specimen having hitherto been found, although the beds at Muddiford, High-cliff, and Barton have, probably, been explored more thoroughly than any other Eocene deposit in England. The shell in question does not present the aspect of

shells from that locality ; and I am strongly inclined to think that by one of those accidents, which the greatest care will not always prevent, a shell from the Miocene beds of Germany or Italy has been mixed with Hampshire fossils, and that thus an erroneous locality has been given. The matrix, unfortunately, has been entirely removed, and this evidence is not available. Under these circumstances, I retain the species, for the present, as one of the English Eocene Pleurotomæ, but with much doubt.

Size.—Axis, $1\frac{1}{2}$ inch ; diameter, 4-12ths of an inch.

Locality.—Muddiford ?

NO. 181. PLEUROTOMA NODULOSA. *Lamk.* Tab. XXIX, fig. 7, *a—c*.

PLEUROTOMA NODULOSA. *Lamk.* 1804. Ann. du Mus., vol. iii, p. 170, No. 18.

— — — 1822. Histoire Naturelle, &c., vol. vii, p. 101, No. 25.

— — — *Desh.* 1824-37. Descr. des Coq. foss., &c., vol. ii, p. 466, t. 65, fig. 11—14.

P. testá elongatá, fusiformi, undique spiraliter lineatá: spirá elevatá, acuminatá: anfractibus ad humeros angulatis, nodulosis; lineis filiformibus, sub-regularibus; nodulis, obtusis, crassis, obliquis: ultimo anfractu per-brevi, postice concavo, antice depresso-convexo, repente coarctato, in canali brevi, latiusculo, obliquo, terminanti: aperturá oblongo-ovali; labro tenue, aliforme; sinu latiusculo, paullo profundo, in margine collocato.

Shell elongated, fusiform, having the whole surface covered with concentric raised lines: spire pointed, produced, much exceeding the aperture in length; whorls angulated at the shoulders, where they present a series of blunt, thickish, rather oblong, tubercles, somewhat distant from each other, very slightly oblique, and becoming feeble and obscure on the last whorl; the posterior margins are a little concave. The last whorl is very short, flatly convex at the sides, contracted rather suddenly in front, and terminates in a short, and somewhat wide canal. The spiral lines are thickish, rounded, thread-like, equal, and nearly regular; the aperture is of an oblong-oval shape; the outer lip thin, wing-like, projecting at the middle, and smooth within; and the sinus, which is placed in the margin, is rather wide, not very deep, and triangular in form.

Lamarck describes the concentric lines which ornament the French shells as very thin; while in the English specimens the lineation is strong and coarse. This difference in the character of the sculpture on the Eocene shells of the two countries is not of unfrequent occurrence, and may be attributed to outward conditions only. The sinus in the outer lip is described by Deshayes as being "narrow and deep;" but in a series of specimens from Grignon, for which I am indebted to that gentleman, the sinus corresponds pretty closely with that found in the English specimens.

In all other respects the shells agree ; and I do not feel any doubt, therefore, as to the accuracy of the identification.

With the Grignon specimens, I received some from Damery, in which the tubercles are thin and compressed, resembling small, oblique ribs ; they form a variety, probably not known to Deshayes at the date of his work above cited, and therefore not noticed by him. Our English shells present the thick rounded tubercles characteristic of the type, and from which the specific name was taken.

Size.—My specimens have not attained the size of the French shells ; of the largest the axis is 9-12ths of an inch nearly (18 millim.) ; the diameter 3·5-12ths of an inch nearly (7 millim.).

Localities.—Stubington. *French* : Grignon, Parnes, Courtagnon, Damery (fide *Desh.*) ; Lattainville (fide *Graves*).

No. 182. PLEUROTOMA NODOSARIA. *F. E. Edwards*. Tab. XXIX, fig. 8 *a, b*.

P. testá turritá, tuberculo-costatá, spiraliter lineatá : spirá acuminatá, elevatá : anfractibus convexis, ad humeros sub-angulatis ; marginibus posticis depressis, vix canaliculatis, ad suturam lineá elevatá cinctis ; ultimo anfractu brevi, antice valde coarctato, in canalem brevem producto ; lineis spiralibus exilibus, proeminentibus, sub-distantibus : aperturá ovata ; labro parum arcuato ; sinu lato, sub-semicirculari, anticá in margine collocato.

Shell narrow, turreted, ribbed, concentrically lined : spire pointed, produced, much exceeding the last whorl in length : whorls convex on the sides, rather bluntly angulated at the shoulders, and crowned with a row of small, oval-shaped, vertical tubercles, impressed by the concentric lines ; the posterior margins are depressed, very slightly furrowed, almost straight, and bordered round the suture by a single slender raised line ; the spiral lines are slender, very prominent, and rather distant. The last whorl is short, and somewhat suddenly contracted towards the front, and terminates in a short, narrowish canal. The aperture is ovate ; the outer lip slightly arched, and the sinus wide, nearly semicircular, and placed in the very front of the margin.

I possess but an imperfect specimen of this species, but the characters are so distinct that it appears worthy of being recorded.

Size.—Axis, 5-12ths of an inch ; diameter 2-12ths of an inch.

Locality.—Southampton.

No. 183. PLEUROTOMA UNDATA. *Lamk.* Tab. XXIX, fig. 11, *a, b*.

PLEUROTOMA UNDATA. *Lamk.* 1804. *Ann. du Mus.*, vol. iii, p. 169, No. 9.

— — *Lamk.* 1822. *Hist. nat., &c.*, vol. vii, p. 99, No. 14.

— — *Desh.* 1824-37. *Descr. des Coq. foss., &c.*, vol. ii, p. 456 ; t. 63, figs. 11—13 ; t. 64, figs. 21—23.

Nec	PLEUROTOMA	UNDATA.	Bast. 1825. Mém. Géol. sur les Env. de Bordeaux, p. 64, No. 7.
nec	—	—	V. Hauer. 1837. Fossst. imtert. Becken v. Wien. Jahrb., p. 419, No. 98.
nec	—	—	Grat. 1838. Cat. Zool., &c., du Bass de la Gironde, p. 46, No. 394.
nec	—	—	Grat. 1840. Conchyl. foss., &c., du Bass. de l'Adour (Atlas Pleurot., t. 2, fig. 36).

P. testá elongato-fusiformi, sub-turritá, lineis spiralibus costulisque longitudinalibus ornatá: spirá acuminatá: anfractibus convexiusculis, postice sub-canaliculatis; lineis concentricis crassiusculis, depressis, numerosis, undatis; costulis undatis, variis: aperturá angusto-ovatá, antice in canali brevi exeunti; labro tenuissimo, arcuato; sinu latiusculo, marginibus sub-parallelis, anticá in margine collocato.

Shell oblong, fusiform, somewhat turreted, ornamented with spiral lines and longitudinal ribs; the spire pointed, produced, always exceeding the last whorl in length; whorls eight or nine (exclusive of a smooth, conical pullus of three volutions), convex, short, and bluntly angular on the shoulders. The posterior margins are slightly channelled; the sutural edges, in the young shells, are frequently bordered by a single row of small, roundish tubercles, which disappear on the fourth or fifth whorl, and the edges then become feebly and distantly crenulated, or they present three or four prominent, thread-like lines. The concentric lines are numerous, irregular, fine and thread-like over the margins, rather thick and depressed over the middle and front parts of the whorl, and slightly wavy on the last whorl; the longitudinal ribs are short, oblique, curved, and very variable in different specimens, both in size and number, sometimes being moderately large and distant, sometimes small and crowded. The aperture is of an oblong-oval form, and terminates in front in a short, somewhat narrow, and nearly straight canal; the outer lip is very thin, much arched, and expanded towards the middle; the sinus is moderately wide, deep, with nearly parallel margins, and placed in the very front of the margin, immediately behind the shoulder.

The transverse lineation in the English specimens is, as is not unfrequently the case, of a coarser character than that found in the French shells; and there is also a slight difference in the condition of the posterior margins. These variations, however, do not appear to be of sufficient importance to justify the separation of the English shells.

Size.—Axis, 1 inch and 2-12ths (30 millim.); diameter, nearly 5-12ths of an inch (10 millim.).

Localities.—Stubington; *French*: Grignon, Parnes, Mouchy, Courtagnon (fide *Desh.*), Saint-Felix, Ully-Saint-Georges (fide *Graves*), la Vallée de l'Aisne (fide *Melleville*).

No. 184. PLEUROTOMA BRACHEIA. *F. E. Edwards.* Tab. XXIX, figs. 9, *a*, *b*.

P. testá parvá, sub-fusiformi, turritá, longitudinaliter costatá, concentrice lineatá: spirá obtusiusculá aperturam in longitudine paullo superanti: anfractibus planulatis, ad humeros angulatis, postice concavis, et unicá serie nodulorum munitis; ultimo anfractu valde coarctato, in canalem breviusculum producto; costis numerosis, obliquis, angustis, fere ad basin tendentibus; lineis concentricis sub-distantibus, acutis, irregularibus: aperturá angustá, ovali; labro leviter arcuato, intus prope sinum calloso; sinu lato, brevi, in margine collocato.

Shell small, fusiform, turreted, longitudinally ribbed, concentrically lined: the spire rather thick, and moderately elevated, being a little longer than the aperture: the whorls flat-sided, angulated at the shoulders; the posterior margins narrow, channelled, and furnished with a single row of largish round knobs, alternating with the ribs; the last whorl is much contracted in front, and ends in a wide, somewhat short, and oblique canal. The longitudinal ribs are moderately thick, rounded on the surface, separated by concave spaces as wide as the ribs, oblique, tapering towards the front, and extending to the anterior canal; the concentric lines are distant, prominent, and thread-like. The aperture is of a narrow, oval shape; the outer lip slightly arched, sharp on the edge, thickened within near the apex of the sinus, and presenting two transverse, oblong callosities, similar to those which characterise *P. callifera*; the sinus is shallow, rounded, and wide, extending over the whole of the posterior margin.

The only specimen I possess has probably not attained its full growth, but it presents an union of characters which distinguishes it from all its congeners. It is apparently very rare.

Size.—Axis, 3·5-12ths of an inch; diameter, 1·5-12ths of an inch.

Locality.—Barton.

No. 185. PLEUROTOMA SINDONATA. *F. E. Edwards.* Tab. XXIX, fig. 12, *a*, *b*.

P. testá parvá, gracili, fusiformi, undique spiraliter lineatá, clathratá: spirá sub-conicá, acuminatá: anfractibus convexiusculis, ad humeros sub-carinatis, postice plicatis, marginatis; lineis spiralibus elevatis, filiformibus, irregularibus, suprá margins fere obsoletis; lineá unicá humeros cingenti eminentiori, in juventú denticulatá: aperturá ovali, antice in canali indistincto exeunti; labro leviter arcuato, ad marginem posticam late sinuato.

A small, slender, fusiform shell, spirally lined, and having an elevated, nearly conical and pointed spire, formed of six or seven volutions; the whorls very slightly convex and sharply keeled round the shoulders; the posterior margins wide, sloping gently

backwards, slightly channelled, a little thickened on the sutural edge, and bordered by a thickish raised line, the space between which and the shoulder is ornamented with a series of rather closely set, curved plications, formed by the successive margins of the sinus. The spiral lines are very faint, scarcely visible to the naked eye, over the margins of the whorls, but elevated, thread-like, and irregular over the middle and front parts, where they are strongly decussated by the lines of growth, which are prominent and regular; the surface of the whorls is finely cancellated by these decussating lines, suggesting the idea of the shell being covered with very fine linen; whence the name. The posterior line, girding the shoulders, is more elevated than the rest, giving the whorls the appearance of being sharply carinated; on the early whorls this posterior line is broken into oblong denticulations, which disappear as the shell approaches maturity. The aperture is of an oval form, and terminates in front in a short, wide canal; the outer lip is slightly arched, and presents a moderately deep sinus, extending across the margin, and somewhat triangular in form.

This very pretty shell appears to be quite distinct; it is rare.

Size.—Axis, 5-12ths of an inch nearly; diameter, not quite 2-12ths of an inch.

Locality.—Stubbington.

No. 186. *PLEUROTOMA GRANULATA*. *Lamk.* Tab. XXVIII, fig. 4, *a—c*.

PLEUROTOMA GRANULATA. *Lamk.* 1804. *Ann. du Mus.*, vol. iii, p. 266, No. 21; vol. vii, t. 13, fig. 4, *a, b*.

— — — *Lamk.* 1822. *Hist. nat., &c.*, vol. vii, p. 101, No. 26.

— — — *Desh.* 1824-37. *Descr. des Coq. foss., &c.*, vol. ii, p. 476; t. 67, figs. 1—3.

Non *PLEUROTOMA GRANULATUM*. *Phil.* 1851. *Tert. foss. Magdeb.* (*Palæontograph.*, vol. i, p. 67, No. 127; t. 9, fig. 13).

Var. FORMOSA (*Charlesw.*). *P. testá elongato-fusiformi, sub-turritá, longitudinaliter granulato-costellatá, concentrice lineatá: spirá productá, dimidium totius testæ in longitudine paululo superanti: anfractibus convexiusculis, sub-angulatis, postice sub-canaliculatis, ad suturam granulatis; costellis numerosis, undosis, fere ad basin tendentibus; lineis concentricis crebris, duabus vel tribus lineis posticis proeminentioribus: aperturá oblongo-ovali, in canali brevi, latiusculo exeunti; labro aliforme; sinu lato, sub-semicirculari, in margine collocato.*

Shell elongated, fusiform, ornamented with numerous longitudinal, narrow ribs, which are crossed by concentric, raised lines, and thickened into small, round knobs at the points of intersection, imparting a granulated character to the surface: the spire, formed of seven or eight volutions, is rather obtuse, and moderately elevated, somewhat

exceeding the aperture in length. The whorls are slightly convex; the posterior margins somewhat depressed and concave, giving a turriculate aspect to the spire; a single row of roundish or slightly oblique, oblong granulations runs round the sutural margin, the space between which and the shoulder is nearly equally divided by a raised line granulated by the prolongation of the costellæ over the margins; the costellæ, which are more or less curved in different individuals, extend a little beyond the middle of the whorls, and gradually attenuate as they recede from the shoulders; the concentric lines are prominent, numerous, and irregular; the two lines on the shoulder and on the margin being more elevated than the rest. The aperture is of an oblong, oval shape, and terminates in front in a short, moderately wide canal; the outer lip is thin, sharp on the edge, and wing-shaped; and the sinus, which is wide and nearly semicircular, occupies the whole breadth of the margin.

This *Pleurotoma* is one of the shells figured under the superintendence of Mr. Charlesworth, for the British Natural History Society, and the elegant ornamentation which characterises it, well merits the epithet selected for a specific name. The shell, however, in its general form and the character of the ornamentation, so closely resembles *P. granulata* (Lamk.), that it is difficult, if not impossible, satisfactorily to separate the two. It will be found, on comparison, that the English shell is broader, the spire not so pointed, and proportionately shorter, and the aperture, consequently, relatively longer than in the French shell. These distinctions may fairly be attributed to external conditions, and I therefore regard the English shell not as a separate species, but merely as a strongly marked local variety of *P. granulata*.

Size.—Axis, 5-12ths of an inch nearly (10 millim.); diameter, 2-12ths of an inch (4 millim.)

Localities.—Barton, Alum Bay (Stratum No. 29, Prestwich); Highcliff, where it occurs in such profusion that it may be regarded as one of the characteristic shells of that deposit; and Bracklesham Bay. *French*: Grignon, Parnes, Mouchy, Courtagnon (fide *Desh.*), Monneville, Varinfroy (fide *Graves*).

No. 187. *PLEUROTOMA HEADONENSIS*. *F. E. Edwards*. Tab. XXVIII, fig. 17, *a—c*.

PLEUROTOMA HEADONENSIS. (Edw. MSS.) *Morris*. 1856. Forbes's Tert. Fluv. Mar. Format., &c.; Mem. Geol. Surv., p. 155, t. 5, fig. 4.

P. testâ gracili, fusiformi, longitudinaliter semi-costellatâ, spiraliter sulcatâ: spirâ elevatâ, longitudine dimidium totius testæ paulo superanti: anfractibus convexiusculis, postice unico sulco profundo exaratis, ad suturam marginatis; costellis numerosis, brevibus, angustis, obliquis; sulcis spiralibus regularibus, sub-distantibus: aperturâ elongato-ovali, in canali latiusculo, brevi, excavanti; labro leviter arcuato; sinu sub-triangulari, lato, minime profundo.

Shell slender, fusiform, longitudinally ribbed, and concentrically furrowed; spire pointed, elevated, forming rather more than half of the whole shell; whorls, six or seven, flatly convex; slightly thickened at the posterior edge, and bordered by a spiral, sharp, elevated, ridge-like line, which runs round the sutural margin, the space between which and the shoulder presents a deep, round furrow, obliquely plicated by the successive margins of the sinus. The longitudinal ribs are numerous, oblique, rounded, and very short, barely extending to the middle of the whorl, and frequently altogether lost on the last whorl; the spiral furrows are regular, moderately distant, and rather deep. The aperture is of a lengthened, ovate form, and terminates in front in a short, but distinct, and moderately wide, canal; the sinus is somewhat three-cornered in shape, wide, but not very deep, and placed in the margin.

Size.—Axis, 3-10ths of an inch; diameter, 1-8th of an inch.

Localities.—Headon Hill, Colwell Bay, Hordwell (Upper Marine formation), Lyndhurst; and Whitecliff Bay (fide *Forbes*).

No. 188. *PLEUROTOMA VICINA*. *F. E. Edwards*. Tab. XXIX, fig. 10, *a*, *b*.

P. testá parvá, politá, gracili, fusiformi, omnino concentrice crebri-sulcatá: spirá sub-conicá: anfractibus planulato-convexis, in juventá costellatis et sub-angulatis; marginibus posticis declivis, vix cavatis, plicatis, unicá lineá elevatá prope suturam cinctis: aperturá angustá, ovali, antice in canali brevi, lato exeunti; labro acuto, arcuato; sinu lato, sub-trigono, anticá in margine collocato.

Shell small, polished, slender, fusiform, ornamented with numerous, close-set, shallow furrows: the spire elevated, forming rather more than half of the shell; the whorls, six or seven, very slightly convex; the posterior margins, which slope gently backwards, are nearly straight, giving a sub-conical shape to the spire, and are girt round the suture by a single elevated, ridge-like line, in front of which appears a series of numerous curved plications formed by the successive margins of the sinus. The early whorls are obliquely ribbed and slightly angulated at the shoulders, but both these characters disappear as the shell approaches maturity. The aperture is of a narrow, oval shape, and terminates in front in a short, wide canal; the outer lip is sharp on the edge, arched, projecting most towards the anterior extremity; and the sinus, which is wide, moderately deep, and sub-trigonal in form, is placed in the very front of the margin.

This shell very closely resembles *P. Headonensis*, of which it may perhaps prove to be merely a variety. It is distinguished by the more slender form, the shorter spire, the more closely furrowed and less convex whorls, the absence of the costellæ,

except in the young state, and the nearly straight margins of the whorls instead of the deeply furrowed margins which characterise that species.

Size.—Axis, 4-12ths of an inch; diameter, 1-8th of an inch.

Locality.—Alum Bay (No. 29, Prestwich); rare.

No. 189. *PLEUROTOMA TURPIS*. *F. E. Edwards*. Tab. XXVIII, fig. 2, *a—c*.

P. testâ elongatâ, fusiformi, spiraliter sulcatâ, in juventâ costellatâ: spirâ productâ, bitridentes totius testæ in longitudine fere æquanti: anfractibus convexiusculis; ad humeros angulatis; postice declivis, late cavatis, ad suturam crenulatis; ultimo anfractu antice sensim attenuato, in canali perbrevis terminato; sulcis spiralibus crebris, undulatis, obscuris: aperturâ oblongo-ovali; labro arcuato, acuto; sinu sub-triangulari, lato, medio-criter profundo, in margine collocato.

Shell long, fusiform, spirally sulcated, and, in the young state, longitudinally ribbed; the spire much produced, forming nearly two third parts of the whole shell; whorls, seven or eight, slightly convex, angulated at the shoulders; the posterior margins slope gently backwards, are plicated round the sutural edge, and are deeply channeled, imparting somewhat of a turreted character to the spire; the body-whorl tapers towards the front with so gradual a contraction as to be almost conical. In the young shell the whorls present rather numerous, nearly straight ribs, which are lost about the fourth or fifth whorl. The spiral furrows are shallow, close-set, slightly undulating, obscure, and frequently decussated by the lines of growth. The aperture is a lengthened, ovate form, and terminates in front in a short, wide, indistinct canal; the outer lip is arched, thin, sharp-edged, and smooth within; and the sinus is three-cornered in shape, not very deep, and wide, extending across the whole width of the margin.

This *Pleurotoma* presents a general resemblance to *P. pyrgota*; the latter species, however, may be easily distinguished by the finely crenulated and more sharply angulated shoulders of the whorls and the prominent, ridge-like line which borders the suture.

Size.—Axis, rather more than 1 inch; diameter, 1-3d of an inch.

Localities.—Clarendon, Southampton.

No. 190. *PLEUROTOMA SUBULA*. *F. E. Edwards*. Tab. XXIX, fig. 13, *a, b*.

P. testâ subulatâ, spiraliter obsolete lineatâ, fere lævi: spirâ clatâ, sub-conicâ: anfractibus antice planiusculis, postice cavatis, ad suturam sub-incrassatis, marginatis;

lineis spiralibus parum eminentibus, undulatis, supra margines posticas exilissimis, crebris, cæteris distantioribus: aperturâ oblongo-ovali (?), in canali brevi exeunti; labro sub-recto; sinu lato, mediocriter profundo, sub-trigono, mediâ in margine collocato.

Shell subulate, concentrically obscurely lined, almost smooth; spire nearly conical, elevated, equalling the aperture in length; whorls six (exclusive of a rather large, smooth pullus), depressedly convex, with gently sloping margins, widely channelled, slightly thickened round the suture, and girt by a narrow, raised band, rounded on the upper surface, and traversed by a single, faint, elevated line; the last whorl is much contracted in front, and terminates in a wide, short, but distinct, canal. The spiral lines are very faint, nearly obsolete, scarcely detracting from the otherwise smooth surface of the shell; over the margins they are close-set, but become more distant over the middle and front parts of the whorls. The aperture is concealed by the matrix, but, apparently, it is of a lengthened oval shape; the outer lip, as displayed by the lines of growth, is but slightly arched, nearly straight; and the sinus, which extends almost across the margin, is wide, moderately deep, and somewhat triangular in form.

The specimen figured is the only one I possess of this *Pleurotoma*; the nearly smooth surface, and tapering, conical spire, associated with the short, anterior canal and marginal sinus, distinguish it, however, from all its congeners.

Size.—Axis, 8-12ths of an inch nearly; diameter, not quite 3-12ths of an inch.

Locality.—Basingstoke.

NO. 191. *PLEUROTOMA LISSA*. *F. E. Edwards*. Tab. XXVIII, fig. 5, *a*, *b*.

P. testâ brevi, latâ, fusiformi, costellatâ, concentrice obsolete sulcatâ, politâ: spirâ sub-conicâ, dimidium totius testæ vix æquanti: anfractibus planulato-convexis, postice canaliculatis, lævibus, marginatis; ultimo anfractu antice coarctato, in canalem brevissimum producto; sulcis transversis rotundatis, distantibus, sulcis anterioribus perspicuis, cæteris obsoletis: aperturâ obovatâ; labro arcuato, acuto; sinu lato, fere semicirculari, in margine collocato.

Shell short, wide, fusiform, with a smooth, shining surface, longitudinally ribbed, concentrically furrowed; spire rather short, barely equalling the aperture in length; whorls, six exclusive of the pullus, flatly convex on the sides; the posterior margins smooth, deeply furrowed, and bordered round the sutural edge by a thick, raised band rounded on the upper surface; the last whorl is slightly contracted in the front, and produced into a short, very wide, canal; the longitudinal ribs are vertical, short, thick, rounded, smooth on the upper surface, and separated by spaces equalling the ribs in breadth; the ribs themselves are lost on the last whorl of the mature shell; the concentric furrows are rather wide; they are rounded and perspicuous over the canal

and front part of the whorl, but become obsolete over the middle and upper parts, so as not to detract from the otherwise smooth and shining surface. The aperture is of a narrowish, oval form; the outer lip arched, projecting slightly towards the front, thin, sharp-edged, and smooth within; and the sinus wide, nearly semicircular, and extending across the whole width of the margin.

The characters of this *Pleurotoma* are sufficiently well marked to merit distinction. Although presenting a close resemblance to *Pleurotoma tereticosta* in the general appearance, yet the smooth and shining surface of the shell, the more obtuse spire, the greater width of the whorls, the thicker and more distant ribs, the more conical form of the body-whorl, and the different condition of the sinus, separate the two species.

Size.—Axis, 5-12ths of an inch; diameter, 2-12ths of an inch.

Locality.—Potter's Bar.

NO. 192. PLEUROTOMA FISHERI. *F. E. Edwards.* Tab. XXXI, fig. 14, *a, b.*

P. testá elongatá, turriculatá, longitudinaliter costatá, concentricè lineatá: spirá productá, acuminatá: anfractibus brevibus, convexis, ad humeros angulatis; marginibus posticis latis, depressis, paululo cavatis, ad suturam tuberculatis; cæterum lævibus; ultimo anfractu sub-conico; costellis latiusculis, rotundatis; lineis concentricis antice distantibus; supra partes medianas anfractuum numerosioribus, irregularibus; supra margines posticas obsoletis: aperturá ovali, in canali brevi, lato exeunti; sinu lato, sub-trigono, anticá in margine collocato.

Shell long, narrow, turreted, longitudinally ribbed, and spirally lined; the spire pointed and much produced, forming nearly two thirds of the whole length of the shell. The whorls, seven or eight without the pullus, are short, angular at the shoulders, and nearly conical in front; the posterior margins wide, depressed, a little concave, and smooth, except on the sutural edge, where they present a single row of rather large and distant rhomboidal knobs, divided by a transverse furrow across the middle. The longitudinal ribs are short, broad, nearly vertical, rounded on the upper surface, and separated by concave spaces as wide as the ribs, which, in the last whorl, become reduced to oblong tubercles. The transverse lines are sharp and elevated, distant, and separated by smooth, flat spaces over the front of the whorls, but they become more numerous and irregular as they ascend the whorl from the middle towards the shoulder, and are altogether lost on the posterior margins. The mouth is of an oval form, and terminates in front in a wide and short, but distinct canal; the outer lip is thin, sharp-edged, and slightly arched, and the sinus, which is placed in front of the margin, is wide and somewhat triangular in shape.

This *Pleurotoma* approaches most nearly to *P. gomphoidea*, but the more turreted

spire, the short, nearly conical whorls, the broad, upright ribs, the distant, transverse lineation, and the short, anterior canal, render it easily distinguishable. I dedicate the species to the Rev. Osmond Fisher, the rector of Elmstead, near Colchester, a zealous and indefatigable fellow-labourer in this branch of Eocene Palæontology, to whose researches I am indebted for the discovery of the locality from which the species has been obtained.

Size.—Axis, not quite 5-12ths of an inch; diameter, 2-12ths of an inch nearly.

Locality.—Brook (New Forest).

No. 193. PLEUROTOMA TALLAVIGNESII. *Rouault*. Tab. XXXIII, fig. 9, *a*, *b*.

PLEUROTOMA TALLAVIGNESII. *Rouault*, 1848. *Descr. des Foss. du Terr. Eocène des Env. de Pau*; (*Mém. Soc. Géol. de France*, vol. iii, 2d ser., p. 482, t. 16, figs. 18, 19.)

P. testá elongato-fusiformi, turritá, transversim irregulariter lineatá, longitudinaliter costellatá: anfractibus convexiusculis, angulatis; postice concavis, ad suturam marginatis: costellis numerosis, angustis, obliquis, bifurcatis; aperturá elongato-angustá, in canalem rectum longiusculum productá; labro arcuato; sinu lato, sub-trigono, in margine collocato.

Shell elongated, fusiform, turreted, longitudinally ribbed, and concentrically lined; the spire moderately elevated, not equalling the last whorl in length: the whorls rather deep and slightly convex, almost flat-sided, and sharply angulated at the shoulders; the posterior margins wide, slanting, concave, and thickened along the sutural edge, where they present either three or four prominent, raised lines, or a narrow, ribbon-like band, sometimes bisected by a concentric furrow: the whole surface between the suture and the shoulders is ornamented by a series of curved plications, caused by the successive edges of the advancing sinus. The longitudinal ribs are numerous, narrow, oblique, much curved, and short, not extending beyond the middle of the whorls; they are not very prominent, and most frequently bifurcate shortly after their origin on the shoulders; the last whorl is much produced in front, where it forms a longish and moderately wide canal. The aperture is of a lengthened oval form; the outer lip is much arched, and presents in the posterior margin a widely sub-trigonal sinus.

The present species affords another instance of the identity of forms hitherto found only in the Lower Eocene deposits in England with forms characteristic of the Nummulitic Beds of France; but the English specimens agree so well with the figures and description given by Rouault, and more especially with his *Var. a*, that the identity can scarcely be questioned.

I have already pointed out the differences between the present species and *P. pyrgota*, the only English Pleurotoma which resembles it.

Size.—If the shell were perfect the axis would be about 1 inch and 4-12ths (34 millim.); diameter, 5-12ths of an inch (11 millim. nearly).

Localities.—Southend, Nuneham. *French*: Bos d'Arros (fide *Rouault*).

*Additional Species**.—Subdivision a. Canal elongated.

No. 194. PLEUROTOMA LEHONII. *Rouault*. Tab. XXXI, fig. 13, a, b.

PLEUROTOMA LEHONII. *Rouault*. 1848. Foss. du Terr. Eocène des Env. de Pau; (Mém. Soc. Géol. de France, vol. iii, 2d ser., p. 485, t. 16, fig. 26.)

P. testá elongato-fusiformi, transversim lineatá, longitudinaliter costellatá: anfractibus convexiusculis; marginibus posticis declivis, ad suturam leviter crenulatis; ultimo anfractu spiram in longitudine superanti; costellis obliquis, angustis; lineis transversis tenuibus, crebris, sub-regularibus: aperturá ovato-angustá, in canalem longum, angustum, sub-rectum, productá; sinu lato, sub-trigono, in margine collocato.

Shell long, narrow, fusiform, longitudinally ribbed, and ornamented with concentric, raised lines; the spire is moderately produced, not equalling the last whorl in length. The whorls are slightly convex, with rather wide, slanting margins, slightly thickened, and very finely crenulated by the lines of growth along the sutural edge. The longitudinal ribs are rather prominent, narrow, not very distant, oblique, and curved, corresponding with the lines of growth, short in front, barely passing beyond the middle of the whorls, but reaching backwards to the very suture; the concentric lines extend over the ribs, and are fine, close-set, regular, and nearly equal. The aperture is of a narrow, ovate form, and terminates in front in a long, narrow, and nearly straight canal; the sinus is wide, sub-trigonal, and placed in the margin.

The English shells agree so well with the description and figures given by *Rouault*, that there does not appear to be any reasonable doubt of their identity with the species described by that author.

Size.—Axis, 7-12ths of an inch, nearly (14 millim.); diameter, 2-12ths of an inch (4.5 millim.)

Localities.—Highgate Archway. *French*: Bos d'Arros (fide *Rouault*).

No. 195. PLEUROTOMA MACRURA. *F. E. Edwards*. Tab. XXXIII, fig. 8.

P. testá elongato-fusiformi, sub-turritá, longitudinaliter costellatá, omnino concentricè lineatá: spirá breviusculá, in longitudine trientem totius testæ vix superanti: anfractibus

* The following three species, Nos. 194, 195, and 196, have been obtained since the publication of the first subdivision of the section distinguished by the sinus being placed in the margin; they are now added in order that the present monograph may contain descriptions of all the known English Pleurotomæ.

convexiusculis, postice concavis, oblique plicatis; ultimo anfractu antice in canalem rectum, prælongum producto; costellis numerosis, rotundatis, brevibus; lineis transversis confertis, supra partes anticæ et medianas anfractuum inæqualibus, supra margines posticas tenuibus, regularibus: aperturâ obovatâ: labro leviter arcuato in margine late sinuato.

Shell long, fusiform, somewhat turreted, ribbed, and ornamented with concentric, raised lines, which cover the whole surface. The spire is pointed and short, scarcely exceeding one third of the whole length of the shell. The whorls are slightly convex, and bear on the shoulders a single row of rather closely set, short, oblique ribs, rounded on the upper surface, and separated by concave spaces as wide as the ribs; the posterior margins are broadly furrowed, and present a series of fine, curved plications, caused by the successive margins of the sinus; the last whorl is much contracted in front, and produced into a very long, straight canal. The transverse lines over the front and middle parts of the whorls are close-set, prominent, unequal, thickish, thread-like lines alternating with slender ones; over the posterior margins the concentric lines are very fine, numerous, equal, and granulated by the marginal plications. The aperture is of an oblong-oval form; the outer lip but slightly arched; and the sinus, which is placed towards the front of the margin, is wide, sub-trigonal, and not very deep.

This species appears to be very rare; and although my specimens are rather crushed, the long, narrow beak is too remarkable to be passed without notice.

Size.—Axis, 1 inch and 1-12th nearly; diameter, 4-12ths of an inch.

Locality.—Finchley.

No. 196. *PLEUROTOMA COCHLIS*. *F. E. Edwards*. Tab. XXXIII, fig. 6.

P. testâ elongato-fusiformi, turrîtâ: spirâ acuminatâ: anfractibus convexis, brevibus, ad humeros obtuse angulatis; postice late excavatis, marginatis, transversim subtilissime lineatis, cæterum lævibus; ultimo anfractu repente coarctato, in canalem longum producto: aperturâ obovatâ; labro alæformi; sinu profundo, sub-trigono, mediâ in margine collocato.

A long, fusiform, turreted shell, with a much-produced, pointed spire, formed of nine or ten whorls: the whorls are convex, and obtusely angulated at the shoulders; the posterior margins remarkably wide, depressed, broadly furrowed, and ornamented with numerous, close-set, very fine, concentric, raised lines, nearly regular and equal, except those near the sutural edge, where five or six concentric lines, thicker and more prominent than the others, form a border round the suture; the middle and front parts of the whorls are smooth; the last whorl much contracted and produced in front into a long, straight canal. The aperture is of an oblong-oval form; the outer lip wing-shaped, projecting towards the front; and the sinus, which is placed in the middle of the margin, is deep and triangular.

This Pleurotoma, which is remarkable for the smooth surface and the short, cup-like form of the whorls, appears to be quite distinct; it presents a close resemblance to *P. regularis* (Van Bened.); but it is narrower, with a more pointed spire; and the whorls are shorter, wider, and with more depressed margins.

Size.—The extremity of the anterior canal is broken off; the axis of the perfect shell would be nearly 3 inches and 1-4th; diameter, 9-12ths of an inch.

Locality.—Shinfield.

SECTION I (*Shells fusiform*) continued.

B.—*Sinus on the shoulder of the whorl.*

a. *Canal elongated.*

No. 197. *PLEUROTOMA ASPERA*. *F. E. Edwards*. Tab. XXIX, fig. 14, *a, b*.

P. testá elongatá, fusiformi, sub-turritá, lineis elevatis longitudinalibus spiralibusque sese decussantibus undique asperatá: spirá elevatá: anfractibus antice planulatis, ad humeros obtuse carinatis, postice cavatis, marginatis; ultimo anfractu in canalem longum contortum, recurvum, producto; cariná tæniolæformi, denticulatá: lineis longitudinalibus acutis undatis; lineis spiralibus præ-eminentibus, denticulatis: aperturá oblongo-ovatá; labro leviter arcuato, acuto, intús plicato; sinu oblongo, profundo, ad humerum collocato.

Shell oblong, fusiform, with a turreted, pointed spire, rather elevated, nearly equalling the aperture in length; the whole surface ornamented with numerous sharp, undulating, longitudinal, raised lines, decussated by concentric, raised lines, more prominent than the longitudinal lines, and denticulated at the points of decussation, imparting a rough character to the shell. The whorls are flat-sided, girt round the shoulders by a narrow, slightly raised, ribbon-like band, which gives to them the appearance of being obtusely keeled; and the posterior margins are concave, slightly thickened at the edge, and bordered by a sharp, elevated line, which runs round the suture; the band on the shoulders presents a series of narrow, vertical tubercles, corresponding with the longitudinal lines. The aperture is of an oblong-ovate form, and terminates in front in a long, narrowish, slightly curved canal, bent backwards at the anterior extremity; the outer lip is a little arched, thin, and sharp on the edge, thickened and strongly plicated within; and the sinus, which is placed on the shoulder, is oblong and very deep, with nearly parallel margins.

Occasionally specimens occur in which the posterior margins of the whorls, between the sutural ridge and the shoulders, are smooth; others, in which the margins

are covered by numerous very fine, closely set lines, either perfectly simple or feebly decussated by the longitudinal lines; and again, others in which the longitudinal lines are almost obsolete.

Size.—Axis, 1 inch; diameter, 4-12ths of an inch.

Localities.—Barton, Highcliff.

No. 198. *PLEUROTOMA CONIFERA*. *F. E. Edwards*. Tab. XXXI, fig. 3, *a*, *b*.

P. testá angustá, elongato-fusiformi, sub-turritá, undique spiraliter lineatá: spirá elevatá, acuminatá: anfractibus ad humeros sub-angulatis, in juventú tuberculatis, deinde angustá tæniolá cinctis; postice leviter cavatis, marginatis; antice planulatis, sub-conicis; ultimo anfractu in canalem latum, mediocriter longum, reflexum productum; lineis spiralibus elevatis, filiformibus, confertis, sæpe irregularibus: aperturá sub-quadratá; labro ad humerum sinuato; sinu latiusculo, profundo, sub-trigono; columellá contortá, antice cristatá.

Shell narrow, elongated, fusiform, sub-turreted, and ornamented with concentric raised lines; the spire pointed, elevated, rather exceeding the aperture in length; the whorls, seven or eight, exclusive of a small, smooth, sharply conical pullus of three volutions, are slightly channelled along the posterior margins, bluntly angulated at the shoulders, flatly convex at the sides, and tapering gradually towards the base; in the young state they present at the angle a row of small, vertical tubercles, but this ornament is lost on the third or fourth whorl, and is thence replaced by a narrow, smooth, ribbon-like band; the posterior margins are thickened round the sutural edge, which is crenulated and bordered by two spiral lines more prominent than the other marginal lines. The last whorl is produced in front into a long, wide canal, curved by the columella, and having the anterior extremity slightly bent backwards; the flattened sides and tapering form of the whorls impart to the spire the appearance of a succession of inverted cones, gradually diminishing in size, each being half concealed by the succeeding one. The elevated spiral lines are numerous and thread-like; sometimes they are regular and equal in size, but more frequently a very fine line intervenes between two thicker lines; and they are generally roughened by the prominent lines of growth. The aperture is sub-quadrate; the outer lip but little arched, thin, sharp-edged, and smooth within; the sinus is placed on the shoulder and is deep, rather narrow, and triangular in form; the columella is slightly twisted, and at the anterior extremity presents a small crest caused by the reflexion of the canal.

The present species appears to be well-marked; I do not know of any other *Pleurotoma* resembling it in the peculiar form of the spire, or in the elegant concentric lineation which adorns it. It is rare.

Size.—Axis, 10-12ths of an inch; diameter, 3-12ths of an inch.

Localities.—Bracklesham Bay, Bramshaw.

No. 199. PLEUROTOMA VOLGERI. *Phil.* Tab. XXX, fig. 13, *a*, *b*.

PLEUROTOMA VOLGERI. *Philippi*. 1846. (Tert. Foss. Magdeb.) Paleontogr., vol. i, p. 69;
t. 10 *a*, fig. 2.

— — *Morris*. 1854. Cat. Brit. Foss., p. 271.

P. testá gracili, fusiformi, turrítá, tuberculatá: spirá acuminatá: anfractibus convexis, ad humeros carinam acutam, serie tuberculorum dentiformium instructam, gerentibus; marginibus posticis latis, concavis, latissimis; ultimo anfractu pluribus lineis spiralibus filiformibus, irregularibus, cincto, antice repente coarctato, in canalem longum producto: aperturá ovali; labro leviter arcuato; sinu latissimo, sub-profundo, triangulari, ad carinam collocato.

Shell slender, fusiform, turreted, tuberculated: spire pointed, elevated, nearly as long as the aperture: whorls, six or seven, exclusive of the pullus, convex, sharply carinated at the shoulders; keel prominent, armed with a single row of rather closely set, small, tooth-like tubercles; the posterior margins wide, concave, and very smooth; the last whorl, which is ornamented over the middle with several thread-like, moderately distant, and nearly equal, raised, concentric lines, is contracted suddenly towards the front, and produced into a long, straight, and rather wide canal. The aperture is oval, the outer lip slightly arched, and the sinus, which is placed on the keel, is very wide, moderately deep, and triangular in form.

In the English specimens, the spire is rather more slender than that of the specimen figured and described by Philippi, and the spiral lines on the last whorl are nearly equal; in all other respects the two shells agree perfectly.

Size.—Axis, 7-12ths of an inch nearly (14 millim.); diameter, rather more than 2-12ths of an inch (5 millim.)

Localities.—Potter's Bar, where this pretty species appears to be very rare. Philippi's specimen is from the neighbourhood of Magdeburg; but the precise locality is not known.

No. 200. PLEUROTOMA WATERKEYNII. *Nyst.* Tab. XXX, fig. 8.

PLEUROTOMA STRIATULA. *De Kon.* (non *Duj.*) 1837. Coq. foss. de Baesele, &c., p. 27,
No. 28, t. i, fig. 6.

— WATERKEYNII. *Nyst.* 1843. Bull. Soc. Géol. de France, vol. xiv, p. 454, No. 29.

— — *Nyst.* 1843. Coq., &c., foss. de Belgique, p. 518, t. 41, fig. 4.

— STRIATULA. *Bronn.* 1848. Index Palæont., p. 1010.

— WATERKEYNII. *D'Orb.* 1852. Prod. de Paléontol., 26^e Étage, No. 195, k.

P. testá elongatá, sub-turrítá, undique concentricè lineatá: spirá elevatá, acutá:

anfractibus convexiusculis, in medio obtuse carinatis; postice sub-concavis; lineis concentricis exilissimis, confertis, regularibus, lineis incrementi perspicuis decussatis: aperturâ ovato-oblongâ, antice in canali longo exeunti; labro alæforme, ad carinam sinuato; sinu angusto, profundo, trigono.

Shell oblong, sub-turreted, having the whole surface ornamented with concentric raised lines; the whorls, seven or eight exclusive of the pullus, are slightly convex, and bear on the shoulders an elevated widish-keel, rounded on the upper surface; the posterior margins are wide and slightly concave; and the last whorl, which is rather suddenly contracted in front, terminates in a moderately long, rather wide, and nearly straight canal. The concentric lines are slender, resembling very fine threads; regular, closely set, and decussated by the prominent lines of growth over the middle and front parts of the whorls; they are more distant and cancellated by the successive reflected margins of the sinus over the posterior margins. The aperture is of an oblong-oval form; the outer lip much arched, nearly semicircular, but projecting a little towards the front, thin and sharp at the edge, and smooth within; the sinus is placed on the shoulder, and is rather narrow, deep, and somewhat triangular in shape.

The ornamentation of the English shells varies from that of the Belgian specimens; in the former, the concentric lines are remarkably slender, crowded over the middle and front parts of the whorls, and more distant on the margins; in the foreign shells, on the other hand, they are thick and strong, and are distant over the middle of the whorls and crowded over the margins. The lines of growth in the English shells appear to be more prominent than in the Belgian specimens, and the concentric lines are therefore strongly decussated in the former, while in the latter they are described by M. de Koninck as *sub-clathratis*. In our specimens also, the successive lips of the sinus are very prominent, and the concentric lines over the margins are strongly decussated. In determining the identity of this shell, the distance in time must be taken into consideration, the Belgian shells belonging to the newer Eocene, and the English to the older Eocene; and notwithstanding the differences indicated, I believe that both are correctly referable to the same species.

The specific name, *striatula*, imposed by M. de Koninck had been previously applied by Dujardin to a Miocene *Pleurotoma* from Mantelin, and the name *Waterkeynii* substituted for it by M. Nyst, must therefore be adopted.

M. de Koninck describes the species as very rare in Belgium; it appears to be equally so in England.

Size.—Axis, 11-12ths of an inch nearly (23 millim.); diameter, 4-12ths of an inch nearly (8 millim.)

Localities.—Potter's Bar. *Belgian*: Basele, Anvers (fide *De Kon.*), Kleyn-Spauwen (fide *Nyst*).

No. 201. PLEUROTOMA MIXTA. *F. E. Edwards.* Tab. XXX, fig. 5, *a*, *b*.

P. testá elongato-fusiformi, turritá, costellatá, concentricè sulcatá simul atque omnino exilissime lineatá et cancellatá: spirá elevatá, obtusá: anfractibus depresso-convexis, obtuse angulatis, prioribus costatis, cæteris ad humeros fasciolá spirali cinctis; postice concavis, ad suturam marginatis; ultimo anfractu coarctato, in canalem longum, obliquum, productum; sulcis concentricis latis, minime profundis; lineis concentricis elevatis, irregularibus, lineis incrementi fortiter decussatis: aperturá oblongo-ovali; labro arcuato, sub-alæformi, ad humerum sinuato; sinu latiusculo, profundo, sub-trigono.

Shell lengthened, fusiform, turreted, ribbed, spirally furrowed, covered with fine, concentric, undulating, raised lines, and cancellated; the spire is rather thick and elevated, exceeding the aperture in length. The whorls are bluntly angulated at the shoulders, flatly convex at the sides, almost conical in front; the posterior margins concave, and slightly thickened and crenulated on the sutural edges, where they present two rather distant concentric lines, more elevated than the rest. The early whorls are obliquely costellated, but the costellæ become feeble and obscure on the penultimate whorl, and are altogether lost on the last whorl, their place being supplied by a smooth, narrow, ribbon-like band, which girds the whorls round the shoulders, and is defined by two prominent lines and traversed along the middle by a third. The last whorl contracts gradually towards the front, and terminates in a long, moderately wide, oblique canal, slightly bent backwards at the extremity. The concentric furrows are wide, rather shallow and rounded, and the concentric lines are numerous, irregular, thread-like, and strongly decussated by the very prominent lines of growth. The aperture is of a lengthened, oval shape; the outer lip much arched, wing-shaped, projecting towards the middle, and apparently smooth within; and the sinus, which is placed on the shoulder, is moderately wide, very deep, and nearly triangular in form.

In the shape of the whorls, this *Pleurotoma* somewhat resembles *P. conifera*; it is, however, a longer shell, and the mixed character of the ornamentation, different from that of any other English *Pleurotoma*, entitles it to specific distinction. It is apparently very rare.

Size.—Axis, 1 inch and a half; diameter, 5-12ths of an inch.

Locality.—Barton.

No. 202. PLEUROTOMA DIVISA. *F. E. Edwards.* Tab. XXXI, fig. 17, *a, b.*

P. testá fusiformi, longitudinaliter costellatá, spiraliter obscure lineatá: spirá obtusá, conicá: anfractibus convexis, postice sulco concentrico exilissime lineato exaratis; costellis crassis, rotundatis, obliquis, curvis, ad suturam tendentibus, sulco marginali divisis; lineis spiralibus confertis, obsoletis: aperturá ovali, antice in canali longiusculo exeunti; labro valde arcuato, ad humerum sinuato; sinu lato, paulo profundo, sub-trigono.

A wide, fusiform shell, longitudinally ribbed and concentrically lined; the spire thick, conical, and elevated, forming nearly one half of the entire length of the shell; the whorls, seven or eight, exclusive of the pullus, convex; the posterior margins narrow, hollowed out by a moderately wide and shallow spiral furrow, the concentric lines over which are more prominent and distinct than those over the other parts of the whorl; the last whorl contracts somewhat suddenly towards the front and terminates in a widish, moderately straight canal. The ribs are numerous, thick, rounded on the upper surface, arched and long, stretching backwards to the sutural margin, and extending in front to the canal; immediately behind the shoulder they are crossed by the marginal furrow, by which they are divided in two, giving to the spire the appearance of being girt by a double row of tubercles. The spiral lines on the early whorls are sharp and distinct; but on the later whorls, except over the marginal furrow, they are so feeble and obscure as scarcely to interfere with the smoothness of the surface. The aperture is oval; the outer lip much and regularly arched; and the sinus, which is placed on the shoulder, wide, shallow, and triangular in form.

The present species appears to be perfectly distinct; it is very rare.

Size.—Axis, 10-12ths of an inch; diameter, 4-12ths of an inch.

Locality.—Bracklesham Bay.

No. 203. PLEUROTOMA SELYSII. *De Koninck.* Tab. XXIX, fig. 17, *a—d.*

PLEUROTOMA SELYSII. *De Kon.* 1837. Coq. foss. de Basele, &c., p. 25, t. 1, fig. 4.

— ROSTRATA. — — Ibid., p. 24, No. 23 (non *Sol.*) (excl. syn.)

— ACUMINATA. — — Ibid., p. 24, No. 24 (non *Sow.*)

— SELYSII. *Nyst.* 1843. Coq. et Polyp. foss. de Belg., p. 515, t. 40, figs. 11 *a*, 11 *b*, and 12.

— — *Nyst.* 1843. Bull. Soc. Géol. de France, vol. xiv, p. 453.

P. testá fusiformi, turrítá, undique concentrice lineatá; spirá acuminatá: anfractibus convexiusculis, postice excavatis, crenulatis, ad humeros tuberculato-plicatis; ultimo anfractu in canalem longiusculum producto; lineis concentricis supra margines et humeros confertis, exilibus, regularibus; cæteris crassioribus, distantioribus, irregularibus; plicis flexuosis: aperturá oblongo-ovalí; sinu latissimo, triangulari, ad humerum collocato.

Shell fusiform, elongated, turreted, concentrically lined: the spire pointed, elevated; whorls, seven or eight, without the pullus, slightly convex; the posterior margins concave and plicated along the sutural edge, where they present two or three very fine, sharp, elevated lines; the shoulders obscurely angulated, and ornamented with a series of rather distant tubercles, which on the early whorls are elongated, straight, and vertical, but on the last whorl become pliciform and curved; the last whorl is much contracted in front and produced into a rather long and widish canal. The concentric lines over the posterior margins and shoulders are close-set, regular, slender, and not very prominent; over the middle and front parts of the whorls they become more elevated, thicker, and more distant, with very fine, thread-like lines occasionally intervening. The aperture is of a narrow, elongated, oval form; the outer lip slightly arched, simple and smooth within; and the sinus, placed on the shoulder, is very wide, moderately deep, and triangular.

A close comparison of the English shells with Belgian specimens has confirmed me in the conclusion at which Mr. Morris and myself had arrived when a series of the latter was first submitted to us by Sir Charles Lyell; the shells from the two localities agree so closely that I do not feel any doubt of their specific identity.

It is a rare shell in England, although apparently abundant in Belgium, and in case the position of the Limburg beds has been rightly determined, the occurrence of this species in England is attended with additional interest from its being another instance of the reappearance of shells of the London Clay period in the fauna of the Upper Eocene epoch under nearly analogous mineral conditions.

Size.—Axis, 1 inch and 7-12ths (40 millim.); diameter, 6-12ths of an inch (13 millim. nearly).

Localities.—Highgate; Hampstead Railway Tunnel; Finchley; Muswell Hill. *Belgian*: Basele, Boom, Anvers (fide *De Kon.*), Rupelmonde, Gremittingen (fide *Nyst*.)

No. 204. *PLEUROTOMA KONINCKII*. *Nyst*. Tab. XXIX, fig. 15, *a*, *b*.

PLEUROTOMA LÆVIGATA. *De Kon.* (non *Sow.*) 1837. Coq. foss. de Basele, &c., p. 27, t. 1, fig. 5.

— *KONINCKII*. *Nyst*. 1843. Bull. Soc. Géol. de Fr., vol. xiv, p. 454.

— — *Nyst*. 1843. Coq. foss., &c., de Belg., p. 517, t. 41, fig. 3.

P. testá elongato-fusiformi, concentrice lineáta: spirá elatá, acuminatá: anfráctibus convexis, ad humeros in juvenlá arcuato-plicatis, deinde inermibus; ad suturam, lineato-marginatis; ultimo anfractu antice gradatim attenuato; lineis concentricis confertis, sub-regularibus: aperturá oblongo-ovali; canali antico, longiusculo, angusto; labro leviter arcuato, ad humerum sinuato; sinu lato, mediocriter profundo, sub-trigono.

A long, fusiform shell, ornamented throughout with concentric, raised lines; the spire, formed of six or seven volutions without the pullus, is pointed and much

produced, equalling the aperture in length. The whorls are convex, and in the young state, the shoulders present a series of curved and rather oblique plications; but as the shell enlarges, these become gradually smaller and indistinct, and at length altogether disappear on the last two whorls. The posterior margins are bordered round the suture by a narrow, elevated band, formed of two fine, undulating, thread-like lines, feebly crenulated; the last whorl tapers gradually and symmetrically towards the front, and terminates in a moderately long and narrow canal; the concentric lines are very numerous, a little more crowded in the margins than over the rest of the whorls, where they are even and regular. The aperture is of a narrow, oval shape; the outer lip thin, and but slightly arched; and the sinus, which is on the shoulder, is wide, moderately deep, and triangular in form.

The present *Pleurotoma* agrees so closely with *P. Koninckii*, that the identification can scarcely be questioned.

Size.—Of the perfect shell, axis rather more than 1 inch and 2-12ths (30 millim. nearly); diameter, nearly 4·5-12ths of an inch (10 millim.)

Localities.—Highgate, Potter's Bar, Hampstead Tunnel. *Belgian*: Basele, Boom, and Lethen (fide *Nyst*.).

No. 205. *PLEUROTOMA GENTILIS*. *Sowerby*. Tab. XXX, fig. 1, *a—c*.

PLEUROTOMA GENTILIS. *Sow*. 1850. *Dixon's Geol., &c., of Sussex*, p. 183, t. 6, fig. 25.

P. testá elongato-fusiformi, turritá, acuminatá, spiraliter lineatá, longitudinaliter costatá: anfractibus antice convexis, postice concavis, ad suturam marginatis; costis numerosis, brevibus, rotundatis; lineis spiralibus supra margines posticas fere obsoletis, cæteris elevatis, irregularibus: aperturá late ovali, in canali longo, angusto, sub-recto exeunti; labro arcuato, acuto; sinu lato, sub-trigono, summum ad humerum collocato.

Var. VETUSTA; testá minori; marginibus posticis anfractuum plus cavatis; costis longitudinalibus crassioribus; lineis spiralibus exilioribus.

Shell fusiform, elongated, longitudinally ribbed, and spirally lined: the spire, consisting of eight or nine whorls, is pointed and moderately produced, nearly equalling the aperture in length: the whorls are convex at the sides, deeply concave round the posterior margins, and somewhat thickened along the sutural edge; the last whorl is much contracted in front, and produced into a long, nearly straight, narrowish canal. The longitudinal ribs are numerous, rounded, and short, barely extending over the middle of the whorl; the concentric lines are nearly obsolete over the hollowed margins, but very prominent over the other parts of the whorls, where they are rather thick and irregular, the lines in front of the shoulder being thicker and more elevated than the rest. The aperture is widely oval; the outer lip much arched, sharp on the edge, smooth within; and the sinus, which is placed at the very top of

the shoulder, almost in the margin, is wide, moderately deep, and somewhat three-cornered in shape.

Specimens occur in the London Clay in which the shell is smaller, the posterior margins of the whorls more roundedly concave, the ribs thicker and less numerous, and the concentric lines much finer and more closely set. I have described these as a variety of *P. gentilis*, but they may possibly be regarded as a distinct species.

Size.—Axis, 1 inch and 3-12ths; diameter, 5-12ths of an inch.

Localities.—Bracklesham Bay, Bramshaw, for the typical form; Clarendon, Alum Bay (Stratum No. 4, Prestwich), for the variety.

No. 206. *PLEUROTOMA COMMA*. Sow. Tab. XXX, fig. 2.

PLEUROTOMA COMMA. Sow. 1816. Min. Con., vol. ii, p. 105, t. 146, fig. 5.

— — ? *Phil.* 1836. Enum. Moll. Sic., vol. i, p. 200, No. 8.

— — ? *Phil.* 1844. Faun. Moll. regn. utr. Sicil., p. 173, No. 11.

P. testá elongato-fusiformi, turritá, costellatá, concentrice lineatá: anfractibus convexiusculis, postice concavis, medio lœvibus, et ibi costellas numerosas, curvas gerentibus: aperturá oratá, in canalem longiusculum, sub-rectum, productá; sinu ad humerum collocato (?).

Shell elongated, fusiform, turreted, ribbed, and concentrically lined; whorls but slightly convex; almost straight-sided, concave along the posterior margins, smooth in the middle, and bearing round the shoulders a row of close-set short ribs, swelled at the upper part, curved and pointed below, somewhat resembling a comma; from which circumstance the specific name was taken. The aperture is ovate, and terminates in front in a moderately long and slightly curved canal; sinus on the shoulder (?).

The specimen on which this species was founded formed part of a collection which belonged to the late Mr. Holloway, of Portsmouth, and was presented by him to the Portsmouth and Portsea Literary and Philosophical Society. I have myself carefully searched through the museum belonging to that institution, for the specimen, but without success; and as I do not know of any other specimen, the above description has been prepared and the figure taken, by the permission of Mr. Sowerby, from those contained in the 'Mineral Conchology.'

Philippi has referred some shells from the basaltic tufa of Militello, in Sicily, to *P. comma*; but in the uncertainty which attends the present species, from the imperfect figure given of it in the 'Mineral Conchology,' and the want of any existing specimen for comparison, the identification must be accepted with hesitation. De Koninck has also erroneously referred to it certain shells from Basele, which Nyst subsequently distinguished as *P. crenata*; and the species has been quoted, by both Nyst and Bellardi, but with doubt, as identical with Basterot's *P. denticula*. To this last-men-

tioned species *P. comma* certainly presents a general resemblance, but is separable from it by the short curved costellæ, which ornament the shoulders, instead of the quadrate tubercles which distinguish *P. denticula*. The English species most closely resembling *P. comma* is *P. obscurata*, a species which may be reasonably expected to occur in the nearly synchronous deposit at Stubbington, and in which the narrow, oblong, compressed tubercles approach very nearly in character to the short costellæ of *P. comma*; the principal distinction appears to be in the condition of the middle of the volutions, which in *P. obscurata* are transversely lined instead of being smooth as in *P. comma*; but, although this difference does not appear to be of much value, I have not ventured, in the absence of any specimen of *P. comma* for comparison, to regard the two species as identical.

Locality.—Stubbington.

No. 207. PLEUROTOMA PRESTWICHII. *F. E. Edwards*. Tab. XXX, fig. 3, *a—d*.

P. testâ elongatâ, sub-fusiformi, longitudinaliter costatâ; spiraliter lineatâ: spirâ elevatâ acuminatâ: anfractibus rotundato-convexis; costellis numerosis, curvis; lineis spiralibus confertis, irregularibus, supra partes medias anfractuum obsoletis; cæteris perspicuis: aperturâ oblongo-ovali; labro arcuato, acuto; sinu ad humerum collocato, lato, profundo, sub-trigono.

Var.: *testâ anfractibus convexiusculis, ad humeros angulatis, antice sub-conicis.*

Shell lengthened, fusiform, longitudinally ribbed, spirally lined: the spire pointed, elevated, rather exceeding the aperture in length: the whorls, eight or nine, roundedly convex, a little thickened round the suture, and very generally bordered by two or three raised lines; the last whorl is much contracted in front and produced into a long, open, narrow canal. The longitudinal ribs are numerous, varying in number in different specimens, rounded, curved, scarcely extending in front to the middle of the whorls, but continued backwards to the very suture; the concentric lines close set and irregular, almost obsolete over the middle of the whorls, but elsewhere prominent and well defined; for the most part they are thick and rounded, but frequently smaller thread-like lines intervene. The aperture is of an oblong-oval shape; the outer lip much arched, projecting at the middle, thin and sharp on the edge, smooth within; and the sinus, which is placed on the shoulder, very wide, rather deep, and triangular in form.

A variety occurs plentifully in which the whorls are less convex on the sides, giving a subconical character to the spire, and are bluntly angulated at the shoulder; and the front part of the last whorl is not so much contracted as in the type.

Size.—Axis, 1 inch and 4-12ths; diameter, rather more than 5-12ths of an inch.

Localities.—Clarendon, where both forms are abundant, and Alum Bay (Stratum No. 4, Prestwich).

No. 208. PLEUROTOMA SIMILLIMA. *F. E. Edwards.* Tab. XXX, fig. 4, *a—c.*

P. testá elongato-fusiformi, sub-turritá, costellatá, omnino spiraliter lineatá: spirá clatá, acuminatá: anfractibus convexiusculis, ad humeros obtuse angulatis; postice concavis, marginatis; costellis numerosis, angustis, sub-rectis; lineis spiralibus confertis, filiformibus, irregularibus: aperturá ovali, in canali longo exeunti; labro arcuato; sinu lato, medio-criter profundo, sub-trigono, ad humerum collocato.

Var. CRASSILINEA; testá anfractibus acute angulatis, tribus vel quatuor lineis supra medias partes cinctis.

A long, narrow, fusiform shell, ribbed and covered with elevated spiral lines: spire sub-turreted, pointed, equalling the aperture in length; whorls, seven or eight exclusive of the pullus, slightly convex, bluntly angulated at the shoulders, hollowed round the posterior margins and thickened at the sutural edges, which are bordered by one or two prominent raised lines. The ribs are numerous, narrow, nearly straight, short, not extending beyond the middle of the whorls, and becoming obsolete on the last whorl of the mature shell; the spiral lines are closely set, fine, thread-like and regular over the margins and shoulders of the whorls, but over the middle these lines alternate with others still more slender. The aperture is oval and produced in front into a long, narrowish, and nearly straight canal; the outer lip is arched, and presents at the posterior part on the shoulder of the whorl, a very wide and moderately deep sinus, triangular in shape.

In the variety noticed, the whorls are more sharply angulated, and they present over the middle, three or four coarse, elevated lines, with an occasional intervening slender line; but in other respects the shells agree with the typical form.

In the general aspect the present species closely resembles *P. Prestwichii*; but it may be distinguished from it by the turreted spire, the depressed concave posterior margins and the less convex sides of the whorls, and especially by the character of the longitudinal ribs, which are more numerous, straighter, and narrower, and do not extend backwards beyond the shoulders; whereas the coarse, obliquely curved ribs in *P. Prestwichii* reach up to the very suture; and the transverse lineation is also of a finer character. From *P. Wetherellii*, to which it also approaches, the present species is separated by the more slender form, the more vertical ribs, and the narrower posterior margins of the whorls.

Size.—Axis, rather more than 1 inch; diameter, 4-12ths of an inch.

Localities.—Highgate, Potter's Bar, Hampstead, Muswell Hill, Southampton. Alum Bay (Stratum No. 4, Prestwich), and Clarendon, at which latter place it is common. The variety occurs at Highgate, Potter's Bar, and Southampton.

No. 209. PLEUROTOMA ZETA. *F. E. Edwards.* Tab. XXXI, fig. 16.

P. testá oblongo-fusiformi, sub-larvi: spirá sub-conicá: anfractibus convexiusculis; marginibus posticis angustis, concavis; ultimo anfractu antice repente coarctato, in canalem longum, angustum, producto, supra canalem obscure lineato: labro vix arcuato, fere recto; sinu lato, minime profundo, ad humerum collocato.

A nearly smooth, oblong-fusiform shell, with a somewhat conical spire; the whorls slightly convex, having narrow posterior margins, obscurely channelled, with a simple sutural edge; the last whorl much contracted in front, and terminating in a long, rather narrow canal, over which appear a number of close-set, irregular, and very obscure concentric raised lines; the outer lip is scarcely curved, nearly straight, projecting towards the front, and the sinus, which is placed on the shoulder, is wide and very shallow.

Although I possess but one specimen, and that imperfect, the smooth surface of the shell, and the narrow, nearly straight outer lip, are characters so uncommon among the fusiform Pleurotomæ, that the present species ought not to be passed without notice.

The outline of the outer lip, indented by the sinus, somewhat resembles the form of the Greek letter *zeta*, from which circumstance the specific name is taken.

Size.—Axis, estimated at 1 inch and 8-12ths; diameter, $\frac{1}{2}$ inch.

Locality.—Bracklesham Bay.

No. 210. PLEUROTOMA TENIOLATA. *F. E. Edwards.* Tab. XXX, fig. 13, *a—c*.

P. testá angustá, elongato-fusiformi, sub-turritá, concentrice lineatá: spirá elatá, acuminatá: anfractibus depresso-convexis, ad humeros teniolá cinctis, in juventú tuberculatis; marginibus posticis latis, concavis, obsolete regulariter sulcatis; ultimo anfractu in canalem longum prolongato; lineis concentricis supra medias partes anfractuum elevatis, sub-distantibus, supra canalem minoribus, crebrioribus, fere obsoletis: aperturá oblongo-ovali; labro sub-aliforme, ad humerum profunde sinuato.

A long, narrow, fusiform, and somewhat turreted shell, spirally lined; the spire pointed and much produced, considerably exceeding the aperture in length; the whorls, seven or eight without the pullus, are flatly convex, separated by a deep and very perspicuous suture, and girt round the shoulders by a narrow, slightly elevated, ribbon-like band, giving to the shell an appearance of being obscurely keeled; in the young state the shoulders present a series of small, rather closely set, tooth-like tubercles, which are lost in the later whorls. The posterior margins are concave, and very wide, sometimes concealing the preceding whorl up to the shoulder; the

hollow space between the suture and the shoulder is traversed by several irregular, shallow, almost obsolete furrows. The body whorl is much contracted in front, whence it tapers gradually to the base, forming a long, wide, and nearly straight canal: four or five concentric lines cross the middle of the last whorl; these lines are rounded, rather distant, and separated by wide concave spaces; over the front of the whorl, and as they descend the canal, the concentric lines become gradually closer and less prominent, and at last are almost obsolete on the anterior extremity of the canal. The aperture is of an oblong-oval form; the outer lip arched, somewhat wing-shaped, projecting slightly towards the posterior extremity; and the sinus, which is placed on the shoulder, is rather wide, very deep, and triangular.

In the series forming part of Mr. Wetherell's collection, two or three specimens occur in which the line of the suture being less decurrent, the margins of the whorls extend quite up to the shoulders; the shell, consequently, is a little wider, and the spire not so much elevated; but this difference appears to be accidental and scarcely constitutes a variety.

Size.—Axis, 1 inch and 1-8th; diameter, not quite 4-12ths of an inch.

Localities.—Highgate Archway, Cuffell.

No. 211. PLEUROTOMA WETHERELLII. F. E. Edwards. Tab. XXIX, fig. 16, a—d.

P. testâ elongato-fusiformi, costellatâ, undique spiraliter lineatâ: spirâ mediocriter elatâ, sub-conicâ: anfractibus sub-angulatis, suturâ perspicuâ separatâ, antice convexiusculis; marginibus posticis latis, sub-rectis; costellis numerosis, curvis; lineis spiralibus medianis distantibus, crassis, præ-eminentibus; cæteris filiformibus, crebrioribus: aperturâ oblongo-ovali, in canali longo exeunti; labro arcuato; sinu lato, profundo, ad humerum collocato.

Shell elongated, fusiform, ribbed and concentrically lined; the spire moderately elevated, rather thick, and nearly conical: the whorls, seven or eight, bluntly angulated at the shoulders, and slightly convex in front; the posterior margins wide and nearly straight. The ribs vary much in size, being more or less lengthened in the direction of the axis in different individuals; the concentric lines over the middle of the whorls are more or less distant, thick, and very prominent; over the shoulders and posterior margins they are finer, thread-like, more closely set, and irregular. The aperture is oblong-oval in shape, and terminates in front in a long, wide, and slightly oblique canal; the outer lip is much arched, thin and sharp on the edge, and smooth within; and the sinus is moderately wide, deep, sub-trigonal, and placed on the shoulder.

A variety occurs in which the posterior margins of the whorls are narrower, and the sutural edges slightly thickened.

The present species is found plentifully at Highgate, and I have dedicated it to my friend Mr. Wetherell, so long and so well known for his zealous labours in the London Clay, and his unrivalled collection of fossils from Highgate and the neighbourhood.

Size.—Axis, 1 inch and 7-12ths; diameter, 6-12ths of an inch nearly.

Localities.—Highgate, Holloway.

No. 212. *PLEUROTOMA FASCIOLATA*. *F. E. Edwards*. Tab. XXX, fig. 12, *a, b*.

P. testá elongatá, fusiformi, sub-turrilatá, omnino spiraliter fasciolatá: spirá elevatá, in longitudine bi-trientes totius testæ superanti: anfractibus planulato-convexis, suturá perspicuá divisís, ad humeros obtuse carinatis; marginibus posticis latissimis, sub-rectis, contra spiram expressis: fasciis spiralibus confertis, crassis, rotundatis, sub-regularibus, lineis incrementi fortiter asperatis: aperturá ovato-oblongá, antice in canali longiusculo, patulo, cæcanti; labro aliforme, acuto; sinu profundo, latiusculo, ad humerum collocato.

Shell elongated, fusiform, sub-turreted, having the whole surface covered with narrow spiral bands; spire pointed, produced, fully equalling three fifths of the shell in length; whorls, seven or eight exclusive of the pullus, flatly convex on the sides, separated by a deep, perspicuous suture, and bearing on the shoulders a wide, slightly prominent keel, rounded on the upper surface, from which the spire derives its turreted appearance; the posterior margins are very wide, nearly straight, and extend up the spire almost to the keel on the preceding whorl; the spiral bands are numerous, thick, rounded on the upper surface, nearly regular, and much roughened, almost cancellated, by the coarse, prominent lines of growth. The aperture is of an oblong-oval form, and terminates in front in a wide, moderately long canal; the outer lip is much arched, and presents at the shoulder a deep and rather wide sinus.

Size.—Axis, 1 inch and 9-12ths; diameter, 7-12ths of an inch nearly

Localities.—Highgate, Railway Tunnel, Kilburn.

No. 213. *PLEUROTOMA DENTICULA*. *Basterot*. Tab. XXX, fig. 7, *a—h*.

PLEUROTOMA DENTICULA. *Bast.* 1825. Descr. Géol. du Bass. tert. Sud-ouest de la France, p. 63, t. 3, fig. 12.

— — *Defr.* 1826. Dict. des Sciences nat., vol. xli, p. 396.

— — *Grat.* 1832. Tab. des Coq. foss., &c., de Dax, p. 320, No. 318.

— — *Grat.* 1838. Catal. zool., &c., du Bass. de la Gironde, p. 46, No. 388.

— — *Desm.* 1842. Rev. de Pleurot., p. 47, No. 25.

- PLEUROTOMA DENTICULA. *Nyst.* 1843. *Descr. des Coq., &c., de la Belg.,* p. 526, t. 44, fig. 2.
- — *Bell.* 1845. *Monogr. Pleurot. foss. Piem. (Mem. R. Accad. Sc. di Torino, 2d ser., vol. ix, p. 576, t. 3, fig. 7).*
- — *Rouault.* 1848. *Foss. du terr. Eocene des Env. de Pau (Mém. Soc. Géol. de France, 2d ser., vol. iii, p. 484, t. 16, fig. 22).*
- SUBCARINATA? *Rouault.* 1848. *Ibid.,* t. 16, fig. 23.
- PLEBEIA. *Sow.* 1850. *Dixon's Geol., &c., of Sussex,* p. 184, t. 6, fig. 23.
- — *Morris.* 1854. *Catal. Brit. Foss.,* p. 270.
- — *Forbes.* 1856. *Mem. Geol. Surv. (Tert. fluv.-mar. form., &c.),* p. 154, t. 5, fig. 1, *a, b* (excl. var. *b*, fig. 2).

P. testá fusiformi, turritá, concentrice lineatá: spirá elatá, acuminatá: anfractibus ad humeros carinatis, tuberculatis; postice concavis, ad suturam lined elevatá, acutá, cinctis; ultimo anfractu brevi, in canalem longiusculum, sub-rectum producto; tuberculis transversim oblongis, medio sulcatis; lineis concentricis supra canalem et margines posticas anfractuum filiformibus, sub-æqualibus, supra medias partes elevationibus, irregularibus: aperturá obovatá; labro arcuato, acuto, ad humerum sinuato; sinu profundo, sub-trigono.

Var. 1, LONGEVA (fig. 7d); testá minori, angustiori: marginibus posticis anfractuum tuberculisque exilissime lineatis; tuberculis distantioribus, crassioribus.

Var. 2, MACROBIA (fig. 7 e); testá breviori: ultimo anfractu tres vel quatuor lineas transversas eminentiores in medio gerenti.

Var. 3, MUTICA; testá spirá obtusiusculá; lineis concentricis ad interstitia inter lineas majores et supra margines exilissimis, confertis, regularibus, æqualibus; tuberculis minoribus, ultimo anfractu sæpe obsolete.

Var. 4, GRACILENTA (fig. 7f); testá minori, graciliori: lineis concentricis elevatis, acutis, regularibus.

Var. 5, CONULUS (fig. 7g); testá graciliori: spirá elatiori, sub-conicá: marginibus posticis anfractuum paullo declivis, vix cavatis; tuberculis minoribus, compressis, dentiformibus; lineis concentricis per lineas incrementi sub-decussatis, postice numerosioribus, regularibus, cæterum distantibus: canali antico breviori.

Var. 6, ODONTELLA (fig. 7 h); testá minori, graciliori: lineis concentricis supra margines anfractuum exilissimis; tuberculis minimis, sub-dentiformibus.

Shell fusiform, turreted, pointed, spirally lined, tuberculated: the spire, formed of eight or nine volutions, exclusive of a longitudinally ribbed conical pullus, is much produced, being nearly double the length of the aperture. The whorls are flatly convex at the sides, and rather broadly carinated at the shoulders, round which they present a series of transversely oblong tubercles, which are furrowed across the middle, and sometimes become obsolete on the last whorl; the posterior margins are narrow, concave, and bordered round the suture by a very prominent, sharp, ridge-like line; and one or two fine concentric lines traverse the hollow of the margins. The concentric lines over the anterior canal are rather close-set, thread-like, and nearly equal; over

the middle of the whorls they become more prominent, thicker, and irregular, very slender lines occasionally intervening between the larger ones: the last whorl is short, and terminates in front in a moderately long, narrow, and nearly straight canal. The aperture is obovate; the outer lip much arched, thin, sharp-edged, and most generally smooth and simple within, although in young specimens from Bramshaw the outer lip is occasionally plicated; the sinus, which is on the shoulder, is moderately wide, deep, and triangular in form.

The present species is widely spread, and in England ranges from the London Clay to the fluvio-marine deposits of Headon Hill; it is very variable, almost every locality presenting some modification of the dimensions or characteristic ornamentation of the shell. The typical forms described by Sowerby as *P. plebeia* are confined to the middle Eocene deposits; in the older deposits the species is represented by two varieties. In the first of these, var. *longæva*, from Highgate, the shell is narrower, and the posterior margins of the whorls, as well as the tubercles, are ornamented with very slender raised lines; this variety is narrower than the shells from the Bolderburg, referred by Nyst to Basterot's species, but it agrees with them in all other respects, particularly in the peculiar modification of the transverse lineation which characterises the latter shells. In the other variety, *macrobia*, from Clarendon, the spire is shorter, the posterior margins of the whorls are smooth, or they only present one or two feeble concentric lines, and the tubercles on the shoulders are more distant, larger, and coarser than in the typical form. In this modification the shells agree with those from Bos d'Arros, forming Rouault's var. D of *P. denticula*; and with it I should also have unhesitatingly associated the shells from the same locality constituting that author's species *P. subcarinata*, were it not for the different condition attributed to them of the embryonal whorls, of which the last two are described as being smooth instead of longitudinally ribbed. But for this distinction, the mature shells could not be satisfactorily separated from those forming the var. D of *P. denticula*, the slight differences which exist in the condition of the transverse lineation and of the tubercles not being, of themselves, of specific value. May not the smooth surface be due to disintegration, the outer layer of shelly matter in the pullus being, in general, more susceptible of decomposition than that in the mature shell? Recognising, however, the value of the character pointed out by Rouault, I have cited his species with doubt.

Among the forms found in the middle Eocene deposits at Bracklesham Bay, Brook, and Bramshaw, are those constituting the variety *gracilentia*; in these the shell is smaller and slenderer, the concentric lines are acute and nearly even, and the tubercles are neither so wide nor so prominent. This variety presents a close resemblance to some shells from Cuise-Lamotte (Sab. inf.), presented to me by M. Deshayes, and by him named *P. denticulata*.

In the upper Eocene deposits at Lyndhurst, Hordwell, Colwell Bay, and Headon

Hill, the species is represented by the variety *odontella*; in this the shell is more slender and shorter than in the typical form; the posterior margins are smooth or very feebly lined, and the tubercles are smaller and more pointed.

Besides these varieties, other forms occur which apparently are confined to the middle Eocene deposits. In the first of these, constituting the variety *mutica*, from Highcliff, the spire is obtuse, the concentric lines over the posterior margins and in the spaces between the prominent lines in front are crowded and so fine as to be barely visible to the naked eye; and the tubercles are very small, close-set, and frequently obsolete on the later whorls, which then present a simple, keel-like line on the shoulders.

In another variety, *convulus*, from Highcliff and Barton, the shell, as in the varieties *gracilentia* and *odontella*, is smaller and more slender than in the type; the spire is more produced, the margins of the whorls are nearly straight, imparting a conical character to the spire; the concentric lines over the margins are sharp, regular, and decussated by the prominent lines of growth, while those over the middle of the whorls are thin, elevated, distant, and simple; the tubercles are small and compressed, frequently assuming a tooth-like appearance; and the anterior canal is short and somewhat oblique. In all these varieties, however, the essential specific characters are preserved.

This species forms one of a group of *Pleurotomæ* which present a very striking similarity in their general aspect and ornamentation; they are all distinguished by the lengthened spire, the prominent transverse lineation, and the obtuse, tuberculated carina on the shoulders of the whorls, caused by the successive thickened extremities of the labial sinus. To this group belong *P. (Murex) monilis* (Brocchi) and *P. trifasciata* (Bellardi); species which appear to be separable from the present, not so much by differences in the transverse lineation or the condition of the carina, as by the greater width of the shells and the shorter and more cup-like form of the whorls. These peculiarities are particularly noticeable in the figure of *P. denticula*, as figured by Basterot. I have not been able to procure any well-authenticated Bordeaux specimens of Basterot's species; but the typical form of the shells described by Sowerby as *P. plebeia* so closely resembles not only specimens from Léoguan, referred to *P. denticula*, with which I have compared them, but also those from Tortona and the environs of Turin referred to the latter species by Bellardi, while the varieties *longæva* and *macrobia* agree so well with the shells from the Bolderberg recorded by Nyst, and those from Pau described by Rouault, that in my opinion the English shells cannot be satisfactorily regarded as specifically distinct. The differences will be found to lie chiefly in the transverse lineation, the condition of the tubercles, or the internal plication of the outer lip. Now, the transverse lineation is a very variable character in the present species, frequently differing in specimens from the same locality; the

tubercles, as already observed, are due to the thickening of the extremity of the sinus, for the more easy protrusion of the excurrent siphon, and they may be reasonably presumed to be liable to variation; and, with regard to the plication of the outer lip, I have adverted to the occurrence of specimens from Bramshaw, in which that character is found. On these grounds I have considered that the shells described by Sowerby as *P. plebeia* ought to be referred to Basterot's *P. denticula*, although the figure given by Basterot is well calculated to lead to a different conclusion.

Size.—Axis, rather more than 1 inch (26 millim.); diameter, not quite 4-12ths of an inch (8 millim.)

Localities.—*London Clay*: Highgate, Potter's Bar, Southampton, Clarendon, Alum Bay (Stratum No. 4, Prestw.) *Middle Eocene*: Bracklesham Bay, Stubbington, Brooke, Bramshaw, Highcliff, Barton, Alum Bay (Stratum No. 29, Prestw.), Brockenhurst. *Upper Eocene*: Lyndhurst, Hordwell, Colwell Bay, Headon Hill, St. Helen's. *French*: Environs of Bordeaux, Dax, Touraine. *Italian*: Tortona, Environs of Turin. *Belgian*: The Bolderberg, near Hasselt.

No. 214. PLEUROTOMA CREBRILINEA. F. E. Edwards. Tab. XXX, figs. 8, a—c.

P. testá elongato-fusiformi, turritá, omnino transversim subtiliter lineatá: spirá obtusiusculá, elevatá: anfractibus depresso-converis, ad humeros fasciolá elevatá cœv carinâ cinctis, postice concavis, marginatis; ultimo anfractu brevi, cyathiformi, antice valde coarctato: aperturá ob-ovatá, in canali longiusculo exeunti; labro leviter arcuato, ad humerum sub-triangulariter sinuato.

A long, fusiform, turreted shell, ornamented with numerous concentric, raised lines; the spire, formed of eight or nine volutions, is rather obtuse, and moderately elevated, forming half the length of the entire shell. The whorls are very slightly convex on the sides, deeply furrowed round the posterior margins, and angulated at the shoulders, round which they are girt by an elevated, ribbon-like band, forming an obtuse keel; the last whorl is short and much contracted in front, which imparts to it a cup-like form. The whole surface of the whorls is covered with numerous, very fine, close-set, raised lines; these lines, over the posterior margins of the keel, are equal and regular, but over the middle and front parts of the whorls they become unequal, other lines, slightly thicker and more prominent, occasionally intervening between the slender lines. The aperture is nearly oval in form, and terminates in front in a moderately long and nearly straight canal; the outer lip is but slightly arched and smooth within, and it presents at the shoulder a wide, three-cornered sinus.

I feel much hesitation in separating this *Pleurotoma* from *P. denticula*, of which it

may be regarded as a variety. The shell, however, is wider, the spire more obtuse, and the body-whorl shorter and more contracted in front; these differences, joined to the peculiar transverse lineation and the smooth, untuberculated keel, have induced me to regard the species as distinct.

Size.—Axis, 10-12ths of an inch; diameter, 4-12ths of an inch nearly.

Locality.—Stubbington.

No. 215. *PLEUROTOMA CALLIFERA*. *F. E. Edwards*. Tab. XXX, fig. 9, *a, b*; fig. 10, *a, b*; fig. 11, *a, b*.

P. testá sub-turritá, omnino concentrice lineatá: spirá obtusiusculá: anfractibus depresso-convexis; ad humeros angulatis, fasciolá tuberculatá sulcoque spirali bipartitá cinctis; marginibus posticis concavis, ad suturam lined elevatá marginatis: lineis concentricis supra medias partes anfractuum et canalem distantibus, irregularibus, per-elevatis, denticulatis: supra humeros et margines posticas exilibus, confertis: aperturá ovali, in canali breviusculo, obliquo exeunti; labro arcuato, ad humerum profunde sinuato, intus callos duos oblongos, alterum verticalem, alterum transversum, gerente; sinu lato, triangulari.

Var. RAPHIUM (fig. 11, *a, b*); *testá minori, angustiori; spirá graciliori; lineis concentricis sub-distantibus, regularibus, simplicibus.*

Var. MONILIGERA (fig. 10, *a, b*); *testá spirá elatiori: anfractibus postice granulato-marginatis; lineis transversis medianis distantioribus, præ-denticulatis.*

Shell elongated, turreted, ornamented with concentric, raised lines; the spire somewhat obtuse and elevated, exceeding the aperture in length; the whorls, seven or eight, flatly convex and angulated at the shoulders, round which runs a narrow, elevated band, traversed along the middle by a deep furrow, and presenting a series of close-set, regular, vertical tubercles, divided by the transverse furrow, and separated by concave spaces as wide as the tubercles; the posterior margins, which slope gently backwards, are concave and bordered round the suture by an elevated, sharp-edged, ridge-like line; the last whorl is much contracted towards the middle, and terminates in front in a rather short, moderately wide, oblique canal. The concentric lines are irregular, prominent, and evenly and rather strongly granulated; they are very fine and thread-like, close-set, regular, and simple, over the shoulders and posterior margins of the whorls; distant over the middle of the whorl, but more close over the canal. The aperture is ovate: and the outer lip, which is arched, thin, and sharp on the edge, presents within two oblong callosities; of these one is narrow, vertical, curved, and distant from the edge, and it extends from the sinus to the canal; the other is placed transversely, immediately over the posterior end of the vertical

callus, with the curved extremity of which it forms a wide, transverse groove, running into the sinus; the sinus is placed on the shoulder, and is wide, very deep, and triangular in form.

Specimens occur rather plentifully at Highcliff, constituting the variety *raphium*, in which the shell is smaller and narrower, the spire more slender and pointed, the margins of the whorls not so concave, and the concentric lines are moderately distant, even, regular, and smooth. Another variety, *moniligera*, is also found, but more rarely, in which the spire is longer, the elevated line bordering the posterior margins of the whorls is coarsely granulated, and the median transverse lines are more distant and more prominently denticulated.

In the general aspect of the shell and the character of the ornamentation, this *Pleurotoma* closely resembles the middle Eocene forms of *P. denticula*; but the callosities which present themselves on the inner surface of the outer lip indicate a peculiar modification of the excretory tube protruded through the sinus, which apparently entitles the present *Pleurotoma* to specific distinction.

Size.—Axis, 8-12ths of an inch; diameter, 3-12ths of an inch.

Localities.—Barton, Alum Bay (Stratum No. 29, Prestw.), Highcliff, where it is abundant, and Brook.

SECTION II. *Shells fusiform.*

B. *Sinus on the shoulder.*

b. *Canal short or indistinct.*

} continued.

No. 216. *PLEUROTOMA MONERMA*. F. E. Edwards. Tab. XXXII, fig. 1, a—c.

P. testá angustá, elongatá, turritá, undique concentrice lineatá: spirá elevatá, in longitudine bitrientes totius testæ fere equanti, acuminatá: anfractibus convexiusculis, postice concavis, ad suturam bi-lineatis, ad humeros sub-angulatis, noduloso-plicatis; ultimo anfractu per-brevi, in canali lato, indistincto exeunti; plicis numerosis, verticalibus, arcuatis, utrâque extremitate sub-nodulosis; lineis concentricis supra margines posticas et humeros anfractuum exilibus, confertis, equalibus, cæterum prominentibus, distantibus, irregularibus: aperturá oblongo-ovalí; labro arcuato, simplici; sinu lato, profundo, sub-trigono, ad humerum collocato.

Shell narrow, elongated, turreted, and ornamented with concentric, raised lines, which cover the whole surface; the spire, formed of seven or eight whorls, exclusive of a smooth, conical pullus of three volutions, is pointed and much produced, being nearly twice the length of the aperture. The whorls are slightly convex and obscurely angulated at the shoulders, where they present a series of regular, rather closely set, vertical plications, transversely furrowed along the middle, and swelled into small tubercles at

each extremity: these plications, which vary much in different individuals and frequently in the same specimen, become gradually less prominent as the shell approaches maturity, and are altogether lost on the last whorl. The posterior margins of the whorls are concave and bordered round the suture by two fine, thread-like, raised lines, frequently granulated by the lines of growth. The concentric lines over the posterior margins and shoulders of the whorls are very fine, closely set, equal, and but slightly raised; over the middle and front parts of the whorl they are distant, irregular, elevated, occasionally faintly granulated, and separated by broad, flat spaces, not infrequently traversed by single, very slender lines. The aperture is of an oblong-ovate form, and terminates in front in a wide, but short and indistinct, canal. The outer lip is much arched, rather wing-shaped, thin and sharp on the edge, and smooth and simple within; and the sinus, which is placed on the shoulder, is wide, very deep, somewhat triangular in form, with a broad extremity.

This *Pleurotoma* presents a remarkably close analogy with *P. uniserialis* (Desh.), to which species, in fact, it has generally been referred. It is, however, a wider and coarser shell, with a blunter spire, and the plications are more vertical, more irregular, and not so crescent-shaped as in the French shells; these variations, joined with the different condition of the sinus, which, in the French shell, is described as narrow, not deep, and with parallel margins, apparently justify a separation of the two shells.

Size.—Axis, one inch and 4-12ths; diameter, rather more than 5-12ths of an inch.

Localities.—*Middle Eocene*; Barton, Highcliff. *London Clay*, Clarendon.

NO. 217. *PLEUROTOMA VARIANS*. *F. E. Edwards*. Tab. XXXI, fig. 12, *a*, *b*.

P. testá elongatá, turritá, omnino concentrice lineatá: anfractibus sub-convexis; ad humeros obtuse angulatis, plicato-crenatis; antice repente coarctatis; marginibus posticis concavis, ad suturam marginatis; plicis angustis, cuneiformibus, obliquis; lineis concentricis posticis numerosis, equalibus; lineis medianis distantioribus, prominentioribus, granulatis: aperturá ovali, in canali patulo, brevi, exeunti; labro leviter arcuato, acuto, intús lævi; sinu ad humerum collocato sub-profundo, triangulari.

Shell elongated, turreted, concentrically lined; the spire, formed of six or seven volutions, is rather thick, pointed, almost mucronate, at the extremity, and much produced, equalling 3-5ths of the entire shell in length. The whorls are slightly convex, bluntly angulated at the shoulders, and ornamented with a single row of narrow, oblique, wedge-shaped crenulations, rather closely set in the early whorls, but becoming more distant on the penultimate and last whorls; the posterior margins are deeply furrowed and thickened round the suture, where they present a sharp, ridge-like line, frequently crenulated. The concentric lines over the posterior margins

and shoulders of the whorls are rather thick, equal, regular, and not very prominent; over the middle they are elevated, more distant, separated by concave spaces as wide as the lines themselves, and granulated; the last whorl is much contracted in front, and terminates in a wide and short, but distinct, canal. The aperture is widely ovate; the outer lip but slightly arched, thin, and sharp-edged, and smooth within; the sinus is moderately deep, rather wide and triangular in form, and placed on the shoulder.

The present *Pleurotoma* closely resembles *P. monerma*, but the plications on the shoulders of the whorls are very distinct in character, and the transverse lineation in this species is bolder, coarser, and more closely set; the aperture is more widely oval, and the sinus also is neither so deep nor so wide. These differences appear to be constant, for although possessing a good series of each species, I do not find specimens presenting intermediate characters, and in a comparison of the two series the eye at once recognises the distinctions.

Size.—Axis, 8-12ths of an inch; diameter, 3-12ths of an inch.

Locality.—Highcliff.

No. 218. *PLEUROTOMA ABNORMIS*. *F. E. Edwards*. Tab. XXX, fig. 14, *a*, *b*.

P. testá sub-turritá, sub-conicá, longitudinaliter costatá, omnino concentricè sulcatá: spirá productá, obtusiusculá: anfractibus concaviusculis, postice canaliculatis, suturá undulatá, simplici divisis; ultimo anfractu in canali angusto, sub-obliquo terminato; costis sub-distantibus, longis, rotundatis, postice obliquis, ad humeros angulatis, antice curvis, attenuatis; sulcis numerosis, sub-æqualibus: aperturá ob-ovatá; labro leviter arcuato, acuto; sinu latissimo, minime profundo, triangulari, ad humerum collocato.

A turreted, nearly conical shell, longitudinally ribbed, and having the whole surface covered with concentric furrows: the spire rather obtuse and much produced, being nearly half as long again as the aperture. The whorls, eight or nine in number, are very slightly convex, channeled round the posterior margin, and separated by a simple suture, rendered undulating by the ribs of the preceding whorl. The ribs are rather numerous (twelve or thirteen), depressedly convex on the upper surface, long, extending from the suture to the canal, and separated by spaces equalling the ribs in width; on the margin the ribs are very oblique, but they are bent at a slightly obtuse angle when they reach the shoulder, whence they are prolonged, and become much attenuated towards the front of the shell, forming a gentle curve corresponding with the outline of the outer lip. The concentric furrows are numerous, regular, moderately deep, rather narrow, and separated by bands somewhat wider than the furrows, and rounded on the upper surface. The aperture is nearly oval, and terminates in front in a short, slightly oblique, and narrow canal; the outer lip is

slightly curved, projecting towards the front, thin, sharp-edged, and smooth within ; the inner lip is very thin ; the columella nearly straight and cylindrical ; and the sinus, which is placed on the shoulder, is very wide, shallow, and triangular.

This singular species appears to be exceedingly rare ; only four specimens are known to me, one of which (the figured specimen) is in my own collection, the other three form part of Mr. Wetherell's collection.

Size.—Axis, 1 inch and 3-12ths ; diameter, 5-12ths of an inch.

Locality.—Finchley.

No. 219. *PLEUROTOMA SCALARATA*. *F. E. Edwards*. Tab. XXXI, fig. 6, *a, b*.

P. testá elongato-fusiformi, turritá, tuberculatá, spiraliter lineatá: spirá acuminatá, elevatá: anfractibus angulatis, brevibus, convexiusculis; marginibus posticis angustis. depressis, ad suturam granulato-lineatis; ultimo anfractu repente coarctato, antice in canalem brevem, obliquum, producto; tuberculis numerosis, obliquis; lineis spiralibus confertis, filiformibus, irregularibus, sub-clathratis: aperturá ovali; labro leviter arcuato, ad humerum sinuato; sinu latiusculo, sub-profundo, sub-trigono.

Shell elongate, fusiform, turreted, tuberculated, spirally lined ; spire pointed, much produced, being more than half as long again as the aperture ; whorls, eight or nine, exclusive of the pullus, angulated at the shoulders, and slightly convex in front ; the posterior margins very narrow, depressed, furrowed, and bordered round the suture by a narrow band, traversed by one or two raised, spiral lines, which are occasionally broken into small, roundish, oblong tubercles ; the last whorl is short, much contracted in front, and produced into a rather wide, short, but distinct, and oblique canal. The tubercles are numerous, oblong, narrow, slightly oblique, and a little compressed anteriorly. The spiral lines are crowded, thread-like, irregular, and unequal, slender lines frequently intervening between thicker lines ; and they are roughened, almost decussated, by the conspicuous lines of growth. The aperture is oval, the outer lip very slightly arched, sharp-edged, and smooth and simple within ; and the sinus, which is placed on the angle of the whorl, is moderately wide, not very deep, and somewhat triangular in form.

The coronated whorls, with their depressed, almost tabulated, margins, and the roughened lineation, give a marked character to this *Pleurotoma*, and will readily distinguish it from *P. obscurata*.

Size.—Axis, nearly 11-12ths of an inch ; diameter, 3-12ths of an inch.

Localities.—Bramshaw, where it is not uncommon. Brooke. and Stubbington.

No. 220. PLEUROTOMA OBSCURATA. Sowerby. Tab. XXXI, fig. 1, a, b.

PLEUROTOMA OBSCURATA. Sow. 1850. Dixon's Geol., &c., of Sussex, p. 184, t. 7, fig. 19.

— — Morris. 1854. Cat. Brit. Foss., p. 270.

P. testá angustá, turritá, omnino concentrice lineatá, undulato-costatá: spirá elevatá: unfractibus numerosis, convexiusculis; postice canaliculatis, ad suturam unicá serie tuberculorum cinctis; antice coarctatis; lineis concentricis crebris, exilibus, regularibus; costis numerosis, brevibus, curvis, ad humeros præ-eminentibus: aperturá ovali, in canali brevi, paullulo reflexo, exeunti; labro aliformi, ad humerum anguste et profunde sinuato; columellá sub-rectá.

A long, narrow, turreted shell, ornamented with numerous curved ribs, and having the whole surface covered with raised, spiral lines; the spire, which is formed of ten or eleven volutions, exclusive of the pullus, is much elevated, forming 3-5ths of the entire length of the shell; the whorls are flatly convex, and much contracted in front; and the posterior margins are slightly channeled, and thickened round the suture, where they present a single row of oblique, oblong tubercles. The ribs are numerous, short, and curved, following the outline of the outer lip; they are thick, rounded, and prominent on the shoulders, imparting somewhat of a turreted character to the spire, and they taper rapidly as they cross the middle of the whorls, where they are lost; the spiral, raised lines are thread-like, numerous, and irregular. The aperture is of a roundish-oval form, and terminates in front in a short, but distinct, rather wide, and nearly straight canal, having the anterior extremity slightly bent backwards; the outer lip is curved, wing-shaped, with the front part much projecting; the sinus, which is placed on the shoulder, is of a narrow, deep, oblong form; the columella nearly straight, and crested by the reflexure of the canal.

Size.—Axis, 1 inch and 3-12ths; diameter, rather more than 10-12ths of an inch.

Locality.—Bracklesham Bay.

No. 221. PLEUROTOMA LIMA. F. E. Edwards. Tab. XXXII, fig. 3, a—c.

P. testá elongatá, sub-turritá, longitudinaliter curvo-plicatá, concentrice scabro-lineatá, tuberculato-carinatá: spirá elatá, obtusá: unfractibus planulatis, ad humeros angulatis; postice concavis, ad suturam granulatis; ultimo anfractu brevi, antice coarctato, in canali brevi obliquo, terminato; plicis longitudinalibus numerosis, acutis, ad basin tendentibus;

lineis concentricis medianis granulato-nodosis, irregularibus, alternatim filiformibus et tænioliformibus; aperturâ ob-ovali; labro aliformi; sinu angusto, profundo, marginibus sub-parallelis.

Shell elongated, slightly turreted, longitudinally plicated, concentrically lined; the spire obtuse, pointed at the extremity, and much produced, being half as long again as the aperture; the whorls, eight or nine, exclusive of a small, smooth pullus of two turns, are nearly straight-sided and angular on the shoulders, where they are girt by a narrow, slightly elevated band, which is furnished with a single row of small, close-set tubercles, in some few specimens rounded or oblong, but most generally narrow, curved, and pliciform; the posterior margins are narrow, concave, and bordered round the suture by a band, formed of two or three concentric lines more prominent than the rest, and presenting a series of small, oblong, or roundish tubercles; the last whorl is much contracted in front, where it forms a rather wide, short, but distinct, and oblique canal, notched at the extremity. The longitudinal plications are numerous, sharp, and curved, and they extend to the very base of the shell; the concentric lines over the shoulders and posterior margins are undulating, regular, even, rather thick, and separated by perspicuous furrows; over the middle and front parts of the whorls they are depressed, irregular, and unequal, narrow ribbon-like lines alternating with fine thread-like lines; at the points where they are intersected by the longitudinal plications, they rise into oblong tubercles, or become coarsely granulated, as the concentric line is more or less broad. The aperture is nearly oval; the outer lip wing-shaped, projecting most towards the posterior extremity, very thin and sharp on the edge, and smooth within; and the sinus, which is on the shoulder, is narrow and very deep, with nearly parallel margins.

The roughly granulated surface of this *Pleurotoma* has somewhat of the aspect of a coarse file, from which resemblance the specific name is taken. The species presents a very close analogy with the variety recorded by Deshayes of *P. bicatena* (Lamk.) In the French shells, however, the margins of the whorls are more depressed, and the spire, consequently, is slenderer, and tapers more regularly; the tubercles on the shoulders are longer, more prominent, and more distant, and the anterior canal is wider. In the shape and position of the sinus, as well as in the condition of the sutural tubercles and of the transverse sculpture, the shells agree, except that the decussation caused by the more prominent lines of growth have given to the English shells the scabrous aspect which characterises them. It may, perhaps, be considered as merely a strongly marked variety of Lamarck's species.

Size.—Axis, 10-12ths of an inch; diameter, 3-12ths of an inch.

Localities.—Barton, Alum Bay (Stratum, No. 29, Prestw.), and Highcliff, at all of which places it is somewhat rare.

No. 222. *PLEUROTOMA RETICULOSA*. *F. E. Edwards*. Tab. XXXII, fig. 4, *a*, *b*.

P. testá elongato-fusiformi, undique concentricè lineatá: spirá acuminatá: anfractibus convexis, ad humeros sub-angulatis et tæniolá depressá, obsolete curvo-plicatá et sulco spirali angusto exaratá, cinctis; postice concavis, ad suturam marginatis; ultimo anfractu in canallem latum brevem, antice reflexum, producto; lineis concentricis supra margines et humeros anfractuum confertis, tenuibus; cæterum fortibus, sub-distantibus, irregularibus; omnino lineis incrementi asperatis: aperturá oblongo-ovali; labro arcuato, acuto, ad humerum sinuato; sinu latiusculo, profundo, sub-trigono.

Shell elongated, fusiform, having the whole surface covered with spiral, raised lines; spire pointed, produced, nearly equalling the aperture in length. The whorls, six or seven in number, are convex and bluntly angulated at the shoulders, which present a depressed, narrow, ribbon-like band, bearing a series of rather closely set, faint, crescent-shaped plications, formed by the successive rounded extremities of the sinus, and which are divided along the middle by a narrow but perspicuous furrow; the posterior margins are slightly concave, and bordered round the sutural edge by a coarse, elevated line; the last whorl is produced in front into a short, very wide, and slightly curved canal, the anterior extremity of which is bent a little backwards. The concentric lines are numerous and irregular, slender, and rather closely set over the margins and shoulders, but distant, thread-like, and much elevated over the middle and front parts of the whorls; and they are decussated by the perspicuous lines of growth, whence the surface has somewhat the appearance of being covered with fine network. The aperture is of a lengthened, oval form; the outer lip arched, thin, sharp at the edge, and smooth within; the sinus, which is placed at the shoulder, is rather wide, deep, and somewhat triangular in form, with a rounded extremity; and the columella is nearly straight, and presents a small crest in front.

In the general character of the ornamentation this *Pleurotoma* resembles *P. conifera*; but the lineation is of a rougher and more decided character; the shell itself is wider, the spire relatively shorter, the whorls more convex, the anterior canal shorter and wider, and the sinus not so deep nor so narrow. These differences strike the eye at once on comparing the two; and as the present shell occurs in a newer and distinct formation, I have retained it as a distinct species.

From *P. crenata* (Nyst), with which it also presents a close analogy, it is separable by the wider and more concave margins, and the crenulated and tuberculated shoulders of the whorls in that species.

Size.—Axis, 1 inch and 1-12th; diameter, 5-12ths of an inch.

Locality.—Barton, where it is rare.

No. 223. PLEUROTOMA ROTELLA. *F. E. Edwards.* Tab. XXXI, fig. 4, *a, b.*

P. testá turritá, longitudinaliter arcuato-costellatá, undique transversim sulcatá: spirá elatá, acuminatá: anfractibus sub rectis, ad humeros angulatis; postice concavis, granulato-marginalis; ultimo anfractu antice repente coarctato, sub-angulato, in canalem brevem, latiusculum, emarginatum, producto; costellis distantibus, angustis, ad basin tendentibus, sæpe bifurcatis, postice sub-tuberculosis; sulcis transversis supra margines posticas et humeros confertis, angustis; cæterum latioribus, distantioribus; aperturá obovatá; labro arcuato; sinu lato, profundo, sub-semicirculari, ad humerum collocato.

A rather wide, turreted shell, longitudinally ribbed, and concentrically furrowed: the spire is pointed, much elevated, being nearly twice the length of the aperture, and formed of four or five volutions, exclusive of a smooth, lengthened, sub-cylindrical pullus. The whorls are nearly straight-sided, and angulated at the shoulders; the posterior margins narrow, concave, and slightly thickened round the suture, where they present a series of small, rounded, rather distant tubercles; the last whorl is suddenly contracted, so as to become obtusely angulated towards the front, and it terminates in a short, but distinct, and moderately wide canal, the anterior extremity of which is notched. The costellæ are rather distant, curved and narrow, and are swelled on the shoulders into small, oblong tubercles; thence they taper gradually, becoming sharp and elevated lines, not unfrequently furcated, towards the front, and they extend to the very base of the whorl; the concentric furrows are narrow, shallow, close-set, and regular over the posterior margins and shoulders, but are wider, deeper, and more distant over the middle and front of the whorls. The aperture is nearly oval; the outer lip thin, sharp-edged, and arched; and the sinus, which is on the shoulder, is wide, moderately deep, and rounded at the extremity.

This species presents some analogy with two *Pleurotomæ* from Cuise Lamotte, at present undescribed, but which have been named respectively *P. plicatella* and *P. normalis* by M. Deshayes, to whom I am indebted for specimens; in the first of these species, however, the shell is more slender, the spire more conical and pointed, the whorls more regularly convex, the posterior margins not so deeply channeled, the anterior canal longer, and the sinus wider and more trigonal; and in *P. normalis* the shell is wider, the spire more conical, the posterior margins of the whorls deeper and simple on the sutural edge, the costæ more distant and shorter, and the canal longer; the transverse ornamentation also consists of very slender, closely set, raised lines, and the sinus is placed in the margin.

Size.—Axis, 5-12ths of an inch; diameter, 2·5-12ths of an inch.

Localities.—Highcliff, where it is not uncommon, and Barton, where it appears to be very rare.

No. 224. *PLEUROTOMA CEDILLA*. *F. E. Edwards*. Tab. XXXI, fig. 5, *a*, *b*.

P. testá turritá, tuberculatá, undique transversim lineatá: anfractibus convexiusculis, ad humeros obscure angulatis, plicatis; postice concavis, tuberculato-marginatis; ultimo anfractu antice in canali lato, breviusculo, terminato; plicis numerosis, angustis, brevibus, arcuatis; lineis transversis regularibus; suprà margines et humeros confertis, filiformibus, æqualibus; cæterum crassioribus, distantioribus: aperturá oblongo-ovali; labro aliformi, ad humerum late breviterque sinuato.

Shell turreted, tuberculated, and concentrically lined; the spire pointed, moderately elevated, barely equalling the aperture in length; the whorls, six or seven, exclusive of a small, conical pullus of two volutions, slightly convex, obscurely angulated on the shoulders, and armed with a row of rather numerous, short, curved, pliciform tubercles; the posterior margins are slightly hollowed, and are thickened round the sutural edge, which is girt by a row of small, knob-like tubercles, not very distant from each other; the last whorl is much contracted in front, and produced into a rather wide and short but distinct, and oblique, canal, notched at the anterior extremity. The transverse lines over the shoulders and posterior margins of the whorls are slender, depressed, regular, equal, and close-set; those over the middle and front of the body whorl are coarser, and more distant, being separated by spaces as wide as themselves; they are somewhat undulating, and are roughened by the lines of growth. The aperture is of an oblong-oval form; the outer lip wing-shaped, projecting at the middle, thin, sharp-edged, and smooth within; and the sinus, which is wide, not very deep, and almost semicircular, is placed on the shoulder.

The present species is distinguished from *P. rotella* by the longer and more convex whorls, the short and curved folds on the shoulders, the wider and somewhat longer anterior canal, and the broader and shallower sinus. Like that species, it presents an analogy with *P. normalis* (Desh., *sp. ined.*), but the wider and straighter posterior margins, with their simple sutural edge, and the more sharply angulated shoulders of the whorls, the more slender and regular concentric lineation, and the marginal position of the sinus of the latter shell, render the two species easily separable.

Size.—Axis, 6-12ths of an inch; diameter, rather less than 3-12ths of an inch.

Localities.—Barton and Alum Bay (Strat. No. 29, Prestw.), at both of which places it appears to be rare.

No. 225. PLEUROTOMA INSIGNIS. *F. E. Edwards.* Tab. XXXII, fig. 14, *a, b.*

P. testá sub-turritá, transversim denticulato-lineatá: anfractibus depresso-convexiusculis, ad humeros angulatis, tuberculatis; marginibus posticis canaliculatis, ad suturam fascioli per-elevatá, fastigii-formi, cinctis; ultimo anfractu, antice costellato, in canalem breviusculum producto; tuberculis numerosis, pliciformibus, obliquis; lineis concentricis supra margines posticas et humeros exilibus, regularibus; supra medium ultimi anfractús distantibus, elevatis, scabratis; aperturá ovali; labro arcuato, ad humerum sinuato; sinu lato, triangulari.

A somewhat broad, turreted shell, ornamented with concentric, raised lines; the spire, which consists of five or six volutions, is pointed and moderately elevated, forming about half the length of the whole shell. The whorls are angulated at the shoulders, and armed with a series of closely set, narrow, laterally compressed, oblique tubercles; the posterior margins are deeply channeled and are girt near the suture by a much-elevated, ridge-like band, which is granulated in the earlier whorls; the last whorl is depressedly convex on the sides, much contracted towards the front, and terminates in a narrow and rather short canal. The concentric lines over the posterior margins and immediately in front of the shoulder, are slender and rather closely set, distinct, and regular: on the middle of the last whorl appear four or five regular, concentric, raised lines; of these, the one nearest the shoulder is granulated and separated from that next in front by a very narrow, concave furrow; the raised line, second from the shoulder, is transversely denticulated, and in front of this appear two other almost equally prominent and moderately distant lines, which are also denticulated; the intermediate spaces are nearly flat, and are traversed along the middle by very fine and scarcely perceptible raised lines, also denticulated. Three or four much elevated sharp, or faintly granulated, concentric lines traverse the canal. The bases of the denticulations on the posterior median line, are prolonged into rather broad, flat, longitudinal ribs, which extend to the origin of the canal. The aperture is oval; the outer lip arched and indented at the shoulder by a very wide, moderately deep, sub-trigonal sinus.

This species presents some analogy with *P. denticula*; but the shell is broader, the spire shorter, the tubercles on the shoulder narrow and fold-like, the sinus much wider, and the sculpture different in character. It is apparently very rare.

Size.—Axis, rather more than 4-12ths of an inch; diameter, 2-12ths of an inch.

Locality.—Alum Bay (Strat. No. 4, Prestw.)

No. 226. PLEUROTOMA FLEXUOSA. *Münster*. Tab. XXXII, fig. 8, *a—c*.

PLEUROTOMA FLEXUOSA. *Munst.* 1835. Leonh. and Bronn, Jahrbuch, p. 449.

— — *Goldf.* 1826—1844. Petrefacta Germ., vol. iii, p. 21, t. 171, fig. 7.

P. testá elongato-fusiformi, longitudinaliter flexuoso-plicatá, spiraliter lineatá: spirá elatá, sub-conicá: anfractibus depresso-convexiusculis; postice ad suturam sulco angusto exaratis, lineato-marginatis, nonnunquam granulatis: aperturá oblongo-ovali, antice in canalem breviusculum, ad basin emarginatum, productá; labro leviter arcuato, ad humerum late sinuato; sinu mediocriter profundo, triangulari.

A long, narrow, fusiform shell, ornamented with numerous longitudinal plications and spiral raised lines; the spire is pointed and elevated, forming almost three fifths of the entire length. The whorls, seven without the pullus, are depressedly convex, nearly flat-sided, imparting a conical aspect to the spire; the posterior margins are rather deeply, but not widely, channeled, and are bordered round the suture by a sharp, prominent line, generally simple, but sometimes crenulated by the lines of growth; the last whorl is much contracted towards the front, and terminates in a wide and short, but distinct, canal, slightly notched at the extremity. The longitudinal plications are narrow and curved, and extend from the sutural border to the middle of the whorl; the spiral lines are numerous, slender, nearly equal, and rounded on the surface. The aperture is of an oblong-oval form, the outer lip very slightly arched, and the sinus, which is on the shoulder, is wide, not very deep, and triangular in shape.

The present species presents a close analogy with *P. Prestwichii*, but it is a narrower and slenderer shell, with a longer spire and less convex whorls, a straighter outer lip, and a shorter anterior canal. Our English specimens agree closely with a specimen of *P. flexuosa* from Hermsdorf, part of a series from the older Tertiaries of Germany, presented by Dr. Wedding to the British Museum.

Size.—Axis, 8-12ths of an inch; diameter, 3-12ths of an inch, nearly.

Localities.—Shenfield, Southampton, Clarendon, Highgate? Alum Bay (No. 4, Prestw.) *German*: Sternberg (fide Goldf.), Hermsdorf (fide Wedding).

No. 227. PLEUROTOMA PUPOIDES. *F. E. Edwards*. Tab. XXXII, fig. 11, *a, b*.

P. testá elongato-fusiformi, omnino concentrice sulcatá: spirá elatá, conoideá: anfractibus sub-convexis, inermibus, postice cavatis; ultimo anfractu ad humerum fasciolá angustá cincto, antice in canalem brevem obliquum prolongato; sulcis concentricis confertis, regu-

laribus, æqualibus: aperturâ oblongo-ovali; labro fere recto; sinu lato, mediocriter profundo, rotundato, ad humerum collocato.

Shell elongated, fusiform, concentrically furrowed; the spire nearly conical and moderately elevated, not quite equalling the aperture in length. The whorls, seven or eight without the pullus, are depressedly convex and are smooth and without ornament on the shoulders; the posterior margins, which slope very gently backwards, are traversed by a rather wide and deep concave furrow, and their sutural edge is simple; the last whorl is girt round the shoulder by a narrow, riband-like band, scarcely elevated above the surface; it is much contracted towards the front, and terminates in a wide and short, but distinct, canal, notched at the anterior extremity. The concentric furrows are numerous, not very deep, even, and regular, and are separated by ridges of equal width with themselves, and rather depressed on the upper surface. The aperture is of an oblong-oval shape; the outer lip is very little arched, nearly straight, and situated on the shoulder; and the sinus is wide, moderately deep, and rounded at the extremity.

This species is closely analogous with *P. flexuosa* (Münst.), of which, perhaps, it may be considered a variety; but the posterior margins are wider and more broadly furrowed, and the whorls do not present the curved costellæ, nor are they bordered round the suture by the sharp, elevated line, found in that species.

Size.—Axis, 9-12ths of an inch, nearly; diameter, not quite 3-12ths of an inch.

Localities.—Clarendon, Alum Bay (Stratum No. 4, Prestwich), and Potter's Bar.

No. 228. *PLEUROTOMA VARIATA*. *F. E. Edwards*. Tab. XXXI, fig. 11.

P. testâ elongatâ, angustâ, sub-cylindricâ, sub-turritâ, longitudinaliter obsolete plicatâ, transversim irregulariter sulcatâ: spirâ elatâ, bi-trientes totius testæ fere æquanti: anfractibus convexiusculis; marginibus posticis paullulo cavatis, ad suturam granoso-lineatis; sulcis transversis supra margines posticas et humeros angustis, confertis; cæterum latioribus, distantioribus: aperturâ ob-ovali, in canali brevi, obliquo exeunte; labro valde arcuato; sinu lato, profundo, ad humerum collocato.

Shell long, narrow, somewhat turreted, and ornamented with obscure longitudinal plications, and irregular concentric furrows: the spire is obtuse, sub-cylindrical, and much produced, being nearly double the length of the aperture. The whorls are depressedly convex; the posterior margins, which slope gently backwards, are very slightly furrowed, and are bordered round the suture by a single row of very small granulations. The transverse furrows over the posterior margins and shoulders of the whorls are narrow, shallow, and irregular, those near the suture being more closely set than the others; over the middle and front parts of the whorls the furrows are broader and

wider apart, being separated by spaces as wide as themselves; they are flattened on the upper surface and roughened by the lines of growth. The whorls present a series of faint, almost obsolete, longitudinal, curved plications, representing the successive edges of the outer lip, and which on the last whorl extend almost to the base. The aperture is nearly oval, and terminates in front in a wide, short, and oblique canal; the outer lip is much arched, thin, and sharp-edged; and the sinus, which is placed on the shoulder, is very wide, deep, and almost semicircular in shape.

Size.—Axis, nearly 6-12ths of an inch; diameter, not quite 2-12ths of an inch.

Locality.—Clarendon, where it apparently is very rare.

No. 229. *PLEUROTOMA WOODII*. *F. E. Edwards*. Tab. XXXII, fig. 10, *a*, *b*.

P. testá turriculatá, omnino concentrice lineatá: spirá elevatá, acuminatá: anfractibus planulatis, ad humeros obtuse angulatis, et cariná latissimá, rotundatá, in medio spiraliter sulcatá, instructis; marginibus posticis angustissimis, depressis: lineis concentricis supra partes medias et anticas anfractuum sub-distantibus, latis, depressis; supra carinam et margines posticas fere obsoletis: aperturá sub-quadratá, in canali brevi exeunte: labro parum arcuato; sinu semicirculari, ad carinam collocato.

Shell turreted and spirally lined, with a pointed, elevated spire, rather longer than the aperture; whorls, eight, exclusive of the pullus, nearly straight at the sides, and obtusely angulated at the shoulders, where they present a very broad, prominent, rounded keel, traversed along the middle by a narrow and shallow furrow, representing the progress of the extremity of the sinus; the posterior margins are exceedingly narrow, depressed, and concave, and are simple on the sutural edge. The concentric lines over the middle and front parts of the whorls are rather numerous, regular, band-like, depressedly convex on the upper surface, and separated by deep concave furrows, equalling the bands in width; over the keel and posterior margins the concentric lines are nearly obsolete. On the early whorls the lines of growth are very perspicuous, resembling small, oblique costæ; these are lost on the last two whorls. The aperture, owing to the somewhat flat sides and the depressed posterior margin of the whorls, is subquadrate in form, and terminates in front in a short, moderately wide canal, rendered slightly oblique by the curve of the columella; the outer lip is very little arched, almost straight, and is smooth within; and the sinus, which is on the keel, is moderately wide and semicircular.

This well-marked *Pleurotoma* is extremely rare; I have dedicated it to Mr. Searles Wood, by whom it was discovered, and to whose liberality I am indebted for the specimen figured.

Size.—Axis, 5-12ths of an inch, nearly; diameter, 2-12ths of an inch.

Locality.—Headon Hill.

No. 230. *PLEUROTOMA CURTA*. *F. E. Edwards*. Tab. XXXI, fig. 2, *a*, *b*.

P. testá parvâ, subfusiformi, turritâ, tuberculo-plicatâ, undique transversim sulcatâ: spirâ sub-conicâ, acuminatâ; anfractibus convexiusculis, ad humeros sub-angulatis, tuberculatis; postice concavis, granulato-marginatis; ultimo anfractu repentissime coarctato, in canalem brevem producto; tuberculis sub-distantibus, oblongis, bifurcis, plicas duas arcuatas formantibus; sulcis transversis confertis, supra canalem perspicuis, cæterum fere obsoletis: aperturâ obovali; labro leviter arcuato; sinu lato, brevi, sub-trigono, ad humerum collocato.

Shell small, rather fusiform, turreted, tuberculous, and concentrically furrowed: the spire, somewhat conical, pointed, and moderately elevated, being of equal length with the aperture. The whorls are very slightly convex, and bluntly angulated at the shoulders, where they are furnished with a row of short, vertical, oblong tubercles, which bifurcate in front, and are produced into two narrow, oblique, unequally arched, fold-like costellæ, which extend to the beginning of the canal; the posterior margins are rather deeply channeled and bordered round the suture by a single row of small, round granulations, corresponding with the tubercles on the shoulders; the last whorl is suddenly and much contracted towards the front, resembling that of *P. coarctata*; the transverse furrows are numerous, perspicuous over the canal, but elsewhere nearly obsolete. The aperture is rather widely oval; the outer lip moderately arched; and the sinus, which is placed on the shoulder, is wide, rather deep, and semi-elliptical in form.

I know only the figured specimen of this species, and this is probably an immature individual. It presents a close resemblance to *P. bracheia*, with which, without a careful examination, it may be easily confounded. On comparing the two shells, however, it will be seen that in the present species the spire is more regularly tapering, the posterior margins a little more depressed and more deeply channeled; the granulations round the suture smaller, and placed opposite to the tubercles on the shoulders, and the body whorl much more contracted. These differences, with the bifurcated tubercles, the different character of the transverse ornamentation, and especially the shape and position of the sinus, are sufficient to entitle the present shell to specific distinction.

Size.—7-24ths of an inch; diameter, 3-24ths of an inch.

Locality.—Alum Bay (Strat. No. 29, Prestw.)

No. 231. *PLEURÔTOMA PUELLA*. *F. E. Edwards*. Tab. XXXI, fig. 15, *a*, *b*.

P. testâ elongato-fusiformi, spiraliter granoso-lineatâ: spirâ elevatâ, obtusiusculâ, sub-conicâ; anfractibus convexiusculis, ad humeros unicâ serie tuberculorum brevium ornatâ;

postice sulco spirali, exilissime lineato, exaratis; ad suturam duplici lineâ elevatâ undulatâ marginatis; ultimo anfractu in canali brevi, latiusculo, recurvo, desinente: lineis spiralibus alternatim crassis et tenuissimis; lineis crassis per-elevatis et per lineis incrementi granulatis: aperturâ ovali; labro leviter arcuato; sinu lato, mediocriter profundo, sub-trigono, ad humerum collocato; columellâ arcuatâ, cristatâ.

Shell elongate, fusiform, and ornamented with concentric, granulated, raised lines; spire thick, nearly conical, and much produced, fully equalling three fifths of the entire shell in length. The whorls, eight exclusive of the pullus, are slightly convex, and girt round the shoulders by a single row of small, oblong, curved, comma-like tubercles; the posterior margins are nearly straight, and furrowed by a broad, deep sulcus, which is traversed by a few concentric lines, so faint as scarcely to detract from the smoothness of the surface; the sutural edge is thickened, and bordered by two closely set, undulating, sharp, raised lines; the last whorl contracts somewhat suddenly in front and terminates in a short, rather wide, and curved canal, slightly bent backwards at the anterior extremity. The spiral lines are unequal, thick prominent lines alternating with very slender, thread-like lines; the larger lines are granulated with much regularity by the successive margins of the outer lip; the smaller lines are but faintly decussated. The aperture is rather widely oval; the outer lip slightly arched and sinuated at the shoulder; the sinus very wide, moderately deep, and triangular in form; and the columella, which is a little twisted, presents a small crest in front.

This species presents an elegant ornamentation, quite distinct in character from that of any other English Eocene *Pleurotoma*. It appears to be exceedingly rare.

Size.—Axis, 11-12ths of an inch; diameter, 4-12ths of an inch, nearly.

Locality.—Barton.

NO. 232. *PLEUROTOMA ACUTISINUATA*. *F. E. Edwards*. Tab. XXXII, fig. 5, *a, b*.

P. testâ elongato-fusiformi, gracili, sub-turritâ, acuminatâ, undique spiraliter lineatâ; anfractibus convexiusculis, ad humeros angulatis, postice declivis, concavis; lineis spiralibus confertis, irregularibus: aperturâ sub-quadratâ, in canali brevi exeunte; labro paululum arcuato; sinu ad humerum collocato, latissimo, minime profundo, trigono, ad apicem acute angulato.

Shell slender, oblong-fusiform, somewhat turreted, and ornamented with concentric, raised lines, which cover the whole surface; spire pointed, elevated, exceeding the aperture in length. The whorls, seven or eight in number, are depressedly convex at the sides, and sharply angulated, almost keeled, at the shoulders; and the posterior margins which slope gently backwards, are slightly channeled and girt by a single raised line round the suture. The spiral lines are close-set, threadlike, equal.

and regular on the posterior margins and shoulders; over the middle of the whorls four or five thicker and coarser lines appear, between which finer lines intervene; and over the front of the last whorl and the canal the lines again become close-set, equal, and regular; the whole are roughened, those over the margins almost decussated, by the lines of growth. The aperture is subquadrate, and terminates in a short, moderately wide, and nearly straight canal; the outer lip is very slightly arched, almost straight; and the sinus, which is very wide, shallow, and pointed at the extremity, is placed on the shoulder.

The transverse lineation, associated with the acutely angular whorls and the wide, pointed sinus, distinguish this *Pleurotoma* from all its congeners; the species is apparently very rare.

Size.—Axis, rather more than 9-12ths of an inch; diameter, 3-12ths of an inch.

Locality.—Bracklesham Bay.

No. 233. *PLEUROTOMA ROTUNDATA*. *F. E. Edwards*. Tab. XXXI, fig. 9, *a, b*.

P. testá oblongo-fusiformi, turritá, omnino spiraliter exilissime lineatá; anfractibus depresso-convexis, ad humeros rotundatis vel obtuse angulatis, in juvenitá arcuato-crenulatis, deinde inermibus; postice sub-depressis, concavis, plicato-marginatis; ultimo anfractu in canalem longiusculum angustum producto; lineis spiralibus confertis, crilibus, inaequalibus, irregularibus; aperturá oblongo-ovali; labro leviter arcuato, ad humerum sinuato; sinu latiusculo, mediocriter profundo, sub-semi-elliptico.

An oblong, fusiform, turreted shell, covered with very fine transverse lines; the spire is somewhat cylindrical, pointed, and produced, nearly equalling the aperture in length. The whorls, six or seven, are depressedly convex, and rounded at the shoulders, which in the young state present a close-set series of narrow, crescent-shaped plications, but which afterwards become round and simple, or occasionally are girt with a very narrow and slightly elevated, keel-like band, imparting an obscurely angulated appearance to the shoulder; the posterior margins are slightly depressed, deeply concave, and bordered round the suture by a prominent band, formed of two or three undulating, raised lines, finely plicated; the last whorl is much contracted about the middle, whence it tapers gradually towards the base, forming a moderately long and rather narrow canal. The spiral lines are very fine, even, and close-set over the posterior margins and shoulders of the whorls; over the middle and front parts they are more distant and irregular, broader and somewhat depressed lines alternating with exceedingly slender lines; and all are more or less feebly granulated by the lines of growth. The aperture is of an oblong-oval shape; the outer lip moderately arched, and the sinus, which is placed on the shoulder, is rather wide, not very deep, rounded at the extremity, and of a nearly semi-elliptical shape.

This species approaches nearly to *P. granata* ; but the depressed and deeply concave margins and rounded shoulders of the whorls give a peculiar character, by which it may readily be distinguished. It also presents a close resemblance to a *Pleurotoma* from the upper and middle Eocene deposits of Germany, figured by Beyrich ('*Die Conchylien des norddeutschen Tertiärgebirges*,' tab. xxix, fig. 4); but descriptions by that author of the *Pleurotomæ* figured by him have not been yet published, and without them, or a comparison of the shells themselves, it is unsafe to express any opinion as to the identity of the two species.

Size.—Axis, 11-12ths of an inch, nearly; diameter, rather more than 4-12ths of an inch.

Localities.—Highgate, Potter's Bar, Chalk Farm.

NO. 234. *PLEUROTOMA GRANATA*. *F. E. Edwards*. Tab. XXXI, fig. 7, *a—c*.

P. testâ oblongo-fusiformi, turrilatâ, undique transversim granoso-lineatâ: anfractibus depresso-concavis, ad humeros obtuse carinatis, noduloso-crenatis; marginibus posticis latis, profunde cavatis, ad suturam incrassatis, lineatis, plicatis; ultimo anfractu antice subconico, in canali lato, brevi, desinente; lineis transversis supra margines et humeros anfractuum exilibus, numerosis, regularibus; supra medias partes crassioribus, inæqualibus, lineis majoribus minoribusque alternantibus; omnino lineis incrementi elegantissime granulatis: aperturâ ob-oratâ; labro tenui, valde arcuato; sinu lato, mediocriter profundo, ad humerum collocato; columellâ contortâ, callosâ.

A broad, fusiform shell, the whole surface of which is beautifully ornamented with finely granulated, concentric, raised lines; the spire, formed of five or six volutions exclusive of the pullus, is turreted, pointed, and moderately elevated, not quite equalling the aperture in length. The whorls are bluntly and obscurely keeled round the shoulders, on which they present a series of rather closely set, oblong, obliquely curved plications, variable in size in different specimens, and frequently lost on the last whorl; the posterior margins are wide, embracing the preceding whorls nearly up to the shoulders, deeply channeled, thickened and finely plicated round the suture, where, occasionally, they are girt with one or two raised lines more prominent than the rest. The suture itself is deep and very perspicuous, owing to the great width of the margin of the whorl. The last whorl is flatly convex and much contracted towards the front, whence it tapers nearly regularly to the base, presenting somewhat of a conical form; and the anterior canal is wide and short, but distinct. The concentric lines over the margins and shoulders of the whorl are numerous, regular, very slender, and thread-like; over the middle and front parts they are thicker and more prominent, closely set, and unequal, larger lines alternating with smaller ones; all are very regularly and closely granulated by the lines of growth. The aperture is of a wide, oval form; the outer lip thin and sharp on the edge, and much arched; the sinus, which is wide, moderately

deep, and triangular, is placed on the shoulder, and the columella is twisted, and bears a single, oblique, and obscure, fold-like callus near the middle.*

This, as well as the preceding, species presents a close analogy with a *Pleurotoma* from the lower Eocene deposits of Germany, figured, but not as yet described, by Beyrich ('*Norddeuts. Tertiärgeb.*,' tab. xxix, fig. 3); and for the reasons before stated, the identity cannot be satisfactorily ascertained.

Size.—Axis, 7-12ths to 9-12ths of an inch, nearly; diameter, rather more than 3-12ths of an inch, nearly 4-12ths.

Localities.—Highgate, Potter's Bar.

No. 235. *PLEUROTOMA PARILIS*. F. E. Edwards. Tab. XXXI, fig. 10, a—c.

P. testá oblongo-fusiformi, undique concentrice lineatá: spirá sub-conicá elevatá: anfractibus convexiusculis, ad humeros obtuse angulatis, incrimibus; marginibus posticis latis, concavis, ad suturam exilissime crenulatis; ultimo anfractu sub-conico, in canalem brevem, latiusculum, prolongato; lineis concentricis confertis, supra partes anticas mediasque anfractuum inequalibus, lineis incrementi asperatis; supra margines regularibus, granulatis: aperturá oblongo-ovali; labro tenui, sub-semicirculari; sinu profundo, marginibus sub-parallelis, ad humerum collocato; columellá contortá, callosá.

Shell elongated, fusiform, and covered with numerous, fine, concentric, raised lines; the spire, formed of seven or eight volutions exclusive of the pullus, is pointed, nearly conical, and moderately elevated, equalling the aperture in length. The whorls are slightly convex, with broad, concave margins, and are separated by a deep, well-defined suture, along the edge of which they present a series of fine crenulations, which give a wrinkled appearance to the margin; in the early whorls the margins overlap the preceding whorls up to the shoulders, but in the later whorls the shoulders are more exposed. The last whorl is nearly conical, and terminates in front in a moderately wide and short, but distinct, canal. The concentric lines are closely set; over the front and middle of the whorls they are irregular and unequal, very slender lines alternating with thicker, thread-like lines, and they are roughened, almost granulated, by the lines of growth; over the margins and shoulders, the concentric lines are even, regular, and finely granulated. The aperture is of an oblong-oval form; the outer lip is much arched, almost semicircular, thin, sharp on the edge, and smooth within, and it presents at the shoulder a wide and very deep sinus, with nearly parallel margins and a rather widely rounded extremity; the columella is slightly twisted, and bears about the middle an obscure, oblique, fold-like callus.

* The callus on the columella of *P. granata*, *P. parilis*, and of some other shells referred to *Pleurotoma*, suggests the propriety of placing those species among the *Borsoniæ*; but this callus is not, in fact, a true fold, but merely a thickening caused by the contortion of the columella; and, therefore, the species in which it is found are carefully excluded by Bellardi from his genus.

The close resemblance which this *Pleurotoma* presents to *P. granata*, both in form and in ornamentation, would lead to its being regarded rather as a variety of, than as distinct from, that species; but the narrower and less concave margins, and the simple, rounded shoulders of the whorls, the more conical form of the spire and of the last whorl, and especially the deep, oblong sinus, distinguish it.

Like *P. rotundata* and *P. granata*, this species presents a close analogy with certain shells from the lower Eocene deposits of Germany, figured, but not as yet described, by Beyrich ('*Norddeutschen Tertiärgeb.*,' tab. xxix, fig. 2); but on the grounds before mentioned, it would be hasty to assume the identity of the English and German shells.

Size.—Axis, 10-12ths of an inch; diameter, 4-12ths of an inch.

Localities.—Highgate, Potter's Bar.

NO. 236. *PLEUROTOMA LÆVIUSCULA*. *F. E. Edwards*. Tab. XXXII; fig. 9, *a*, *b*.

P. testá elongato-fusiformi, sub-turritá, læviusculá: anfractibus convexiusculis; ad humeros in juventú tuberculatis, deinde simplicibus, postice et antice transversim lineatis, cæterum lævibus; marginibus posticis canaliculatis: aperturá oblongo-ovali, in canali angusto, brevi, exeunte; labro leviter arcuato, tenui; sinu lato, breviusculo, sub-trigono, ad humerum collocato.

Shell elongated, fusiform, nearly smooth; the spire, formed of six or seven volutions, is rather thick and pointed, and is nearly as long as the aperture. The whorls are slightly convex, and in the early stages of growth present on the shoulders a series of close-set, oblong tubercles, which become obliterated on the third or fourth whorl, after which the shoulders are smooth; the posterior margins are ornamented by three or four concentric, raised lines; of these the one nearest the suture is sharp and ridge-like, and more prominent than the others, and immediately in front of this the margin is traversed by a rather deep, narrow channel; the other marginal lines are feeble and somewhat obscure; the middle of the whorls is smooth; the front parts and base are covered with numerous, close-set, raised lines, rounded on the upper surface; these lines are irregular and unequal, fine lines alternating with thicker ones. The aperture is of an oblong-oval form, and terminates in front in a narrow, short, but distinct canal; the outer lip is thin, smooth within, and but slightly arched; and the sinus, which is on the shoulder, is wide, not very deep, and somewhat three-cornered.

The smooth surface of this *Pleurotoma* is not a common character, and entitles it to specific distinction.

Size.—Axis, rather more than 7-12ths of an inch; diameter, 5-24ths of an inch.

Locality.—Brockenhurst.

No. 237. PLEUROTOMA TURBIDA. *Solander*. Tab. XXXII, fig. 2, *a—c*.

MUREX TURBIDUS. *Sol.* 1766. *Brand.*, *Foss. Hanton*, p. 19, fig. 31.

PLEUROTOMA COLON. *Sow.* 1816. *Min. Con.*, vol. ii, p. 106, t. 146, f. 7, 8.

— CATAPHRACTA. *Morr.* 1843. *Cat. Brit. Foss.* (1st Edit.), p. 157; (non *Brocc.*)

— COLON. *Morr.* 1843. *Cat. Brit. Foss.* (1st Edit.), p. 157.

— TURBIDA. *Morr.* 1843. *Cat. Brit. Foss.* (1st Edit.), p. 157.

— COLON. *Bronn*, 1848. *Index Palæont.*, p. 1003.

— TURBIDA. *Bronn*, 1848. *Index Palæont.*, p. 1011.

— COLON. *D'Orb.* 1852. *Prod. de Paléont.*, 25^e Etage, p. 359, No. 409.

— TURBIDUS. *D'Orb.* 1852. *Prod. de Paléont.*, 25^e Etage, p. 359, No. 413.

— COLON. *Morr.* 1854. *Cat. Brit. Foss.*, p. 269.

— TURBIDA. *Morr.* 1854. *Cat. Brit. Foss.*, p. 270.

Nec. PLEUROTOMA TURBIDA. *Lam.* *Encycl. Méthod.*, t. 451, f. 8.

Nec. — — *Lam.* *Anim. sans Vert.*, vol. vii, p. 97, No. 5.

Nec. — COLON. *Desh.* 1824-37. *Coq. foss., &c.*, de Paris, vol. ii, p. 492, t. 66, f. 4, 7.

Nec. — — *Nyst*, 1835. *Rech. coq. foss. d'Anvers*, p. 28, No. 26.

Nec. — — *Nyst*, 1836. *Rech. coq. foss. de Hoesselt, &c.*, p. 30, No. 78.

Nec. — — *De Kon.* 1837. *Coq. foss. de Basele, &c.* p. 20, No. 19.

Nec. — TURBIDA. *Nyst*, 1843. *Coq., &c.*, foss. de Belg., p. 513, t. 40, f. 8.

Nec. — — *Grat.* 1847. *Conch. foss., &c.*, de l'Adour, Atlas, t. 3, No. 21, f. 26.

P. testá oblongá, sub-fusiformi, turritá, undique concentrice lineatá: spirá elevatá, obtusá: anfractibus depresso-convexis ad humeros in juventá carinam obtusam crenatam transversim sulcatam, gerentibus, deinde curvo-plicatis: marginibus pasticis concavis, ad suturam scabro-plicatis et duabus vel tribus lineis elevatis, acutis, cinclis: ultimo anfractu sub-conico; lineis concentricis supra margines et humeros anfractuum confertis, crassissimis, sub-aequalibus: supra medias partes nonnullis crassis, prominentibus, fastigiiformibus, distantibus, cæterum exilibus; omnino sub-clathratis: aperturá elongato-ovali, in canali brevissimo, ad basin profunde emarginato, exeunte; labro tenui, sub-semicirculari; columellá contortá, callosá, cristatá: sinu latiusculo, profundo, marginibus sub-parallelis, ad humerum collocato.

Var. β testá anfractibus ad humeros fortiter tuberculatis; lineis concentricis medianis et anticis sub-denticulatis.

Shell oblong, sub-fusiform, turreted, concentrically ridged and lined; spire rather thick, pointed, and much elevated, forming nearly 3-5th parts of the entire length. The whorls, nine or ten without the pullus, are depressedly convex; in the young state they present round the shoulders an obscure, obtuse keel, bearing a closely set series of narrow, vertical, slightly curved tubercles, defined at each end, and occasionally also traversed by fine, raised, thread-like lines; these tubercles and the keel gradually become less prominent as the shell enlarges, and frequently altogether disappear on the last two or three whorls, which then present only a series of numerous very fine, thread-like, curved plications, formed by the successive, rounded extremities of

the sinus; the posterior margins are rather deeply channeled, and are thickened round the suture, where they are girt by two or three fine, raised lines, decussated by numerous, rather coarse plications. The concentric lines in the hollow part of the margins and over the shoulders are numerous, slender, sharp, and regular; over the middle and front parts of the whorls rise several prominent, rather thick, ridge-like lines, varying in number and thickness in different individuals; and over the intermediate spaces two or three fine, thread-like lines are generally found, although in some specimens, in which the ridges approach more closely, these intermediate lines are wanting; all the lines are decussated by the sharp, perspicuous lines of growth giving a finely reticulated aspect to the surface of the shell. The aperture is of a long, narrow-oval shape, and terminates in front in a wide, very short, and indistinct canal, deeply notched at the extremity; the outer lip is almost semicircular, thin, sharp on the edge, and smooth within; the inner lip is rather thick, projecting, and curved outwards at the anterior extremity; the columella is very slightly twisted and bears, about the middle, a single, obscure, fold-like callus; the front part presents a strongly marked crest, due to the anterior notch. The sinus is placed on the shoulder of the whorl, and is deep and moderately wide, with nearly parallel margins.

The present species is very variable in the ornamentation; the most common and most strongly marked variety (*Tar.* β) is the one figured in 'Mineral Conchology' (tab. cxlvi, fig. 8), in which the tubercles on the shoulders are prominent and without the transverse furrow found in the typical form; and the concentric lines over the middle and front parts of the whorls are obscurely denticulated.

The shells figured and described by Sowerby as *P. colon* are, as that author suggested, the young of Solander's species. In the young state the proportions of the spire and of the body whorl are nearly equal, and the character of the ornamentation on the shoulders of the whorls is more strongly marked; and in the figure given by Brander, *P. turbida* is represented as having a wider shell and a more pointed and slenderer spire than, in fact, characterise the species. Without an examination of the shell in all stages of growth, therefore, a doubt of the identity might reasonably be entertained.

The shell described by Lamarck as *P. turbida*, in forgetfulness, probably, of that name having been already used by Solander, is a Sub-Apennine shell, which had already been named *Murex cataphractus* by Brocchi; and this circumstance may have led to the English shell having been at one time referred to Brocchi's species, from which, however, it is quite distinct.

Deshayes also has referred to *P. colon* some shells from the Soissonnais, which, although presenting a close resemblance to the present species, are specifically distinct; the prominent and strongly crenulated band round the suture of those shells, resembling that found in *P. alligata*, is quite different in character to the margination in *P. turbida*; and although the crenulation on the shoulders of the whorls resembles that which is found in the present species, it may have arisen from some variation of

form in the animal, and is not due, as in *P. turbida*, to the successive terminations of the sinus, which in the French shells is placed in the margin of the whorl, and not on the shoulder, as in this species. These two shells, therefore, cannot, with propriety, be referred to the same species; and D'Orbigny has in fact distinguished the French shells by the specific name *pseudo-colon*.

The shells from Basele, Boom, Schelle, and Antwerp, referred in the first instance by Nyst, and afterwards by De Koninck, to *P. colon*, are also specifically distinct, and have been subsequently separated by Nyst, under the name of *P. crenata*.

There still remain to be noticed certain shells from Vliermael and Lethen; these, in the first instance, were also referred by Nyst to *P. colon*; but that author, in his description of the fossils of Belgium, has erroneously considered *P. colon* of Sowerby as specifically distinct from *P. turbida* of Solander, and has treated the shells in question as belonging to *P. turbida*. I have not seen any specimens of the Vliermael and Lethen shells; but, judging from the specimen figured in Nyst's work, apparently a full-grown shell, I do not consider that it has been correctly referred to the present species; the spire is shorter and more conical, the whorls are more convex, the posterior margins wider and less depressed, and the sutural edges not thickened nor girt by the prominent, raised lines found in the present species; the tubercles on the shoulder are much less prominent, the body whorl is contracted in front into a narrow, somewhat lengthened, canal, the outer lip is not so much curved, and the sinus is apparently triangular and much wider and shallower.

Size.—Axis, 1 inch and 11-12ths; diameter, rather more than 7-12ths of an inch.

Localities.—Barton and Highcliff, at both of which places it is very common. In Morris's catalogue, Highgate is also given as a locality for *P. colon*; but I am not aware of the present species having been found there.

No. 238. PLEUROTOMA LIGATA. *F. E. Edwards.* Tab. XXXII, fig. 12 *a, b.*

P. testá scabrâ, elongato-turbinatâ, sub-fusiformi, concentrice fasciolis crassis, quasi funiculis, ligatâ: anfractibus convexiusculis, ad humeros curvi-crenatis; marginibus posticis latis, transversim tenuiter lineatis, et sulco profundo exaratis, ad suturam incrassatis, longitudinaliter crasse plicatis; ultimo anfractu conoideo, in canalem latum, brevem, ad basin paululo emarginatum, producto; fasciolis concentricis crassis, præminentibus, sub-distantibus, rotundatis, interstitiis sub-planis: aperturâ oblongo-ovali; labro valde arcuato, acuto: sinu latiusculo, profundo, marginibus parallelis, ad humerum collocato; columellâ contortâ sub-callosâ, antice cristatâ.

Shell rugged, elongated, fusiform, and ornamented with thick, rounded bands, as if bound with cords; the spire, formed of eight or nine volutions, is nearly conical, and moderately elevated, being as long as the aperture. The whorls present round the

shoulders a series of slightly curved, irregular crenulations, more or less closely set in different specimens; the posterior margins are very wide, covering the preceding whorls up to the shoulders; they are deeply channelled, and much thickened round the sutural edge, so as to form a broad, elevated band, which is crossed by numerous narrow, vertical plications, corresponding with the crenulations on the shoulders; the whole surface of the margins, and also the shoulders, are covered with fine, concentric, raised lines, which are most prominent over the sutural band; the body whorl is flatly convex, nearly conical, and terminates in front in a wide, short, but distinct canal, rather deeply notched at the anterior extremity. The concentric bands are thick and very prominent, rounded on the upper surface, and rather distant; the intervening spaces are flat, and traversed, in some specimens, by one or more thread-like raised lines, and in others by flattened bands, similar in character to the principal bands, but much narrower and less prominent. The aperture is of an oblong-oval form; the outer lip much arched, almost semicircular, thin and sharp on the edge, and smooth within; the sinus, which is placed on the shoulder, is deep and not very wide, with nearly parallel margins; and the columella is slightly twisted, and presents near the middle an obscure callus.

This strongly marked species is, I believe, peculiar to Bramshaw; at least I have not met with it elsewhere. In its general aspect and the character of the ornamentation, it strongly resembles the Soissonnais shells referred by Deshayes to Solander's *P. colon*; but, as I have already pointed out, the sinus in those shells is placed in the marginal furrow, and not on the shoulder, as in the present species.

Size.—Axis, rather more than $1\frac{1}{2}$ inch; diameter, 7-12ths of an inch.

No. 239. *PLEUROTOMA HEMILEIA*. *F. E. Edwards*. Tab. XXXII, fig. 13, *a, b*.

P. testá fusiformi, utrinque sub-conicá, transversim fasciolatá: anfractibus ad humeros obtuse angulatis, in juvená plicatis, deinde lœvibus; antice planulatis, postice declivis, paulo concavis, ad suturam concentrice lineatis; cæterum lœvibus; fasciolis transversis sub-distantibus, parum elevatis, interstitiis concavis; ultimo anfractu ad basin emarginato: aperturá angustá, sub-quadratá, in canali patulo, indistincto, exente; labro leviter arcuato; sinu ad humerum collocato, lato, profundo, marginibus sub-parallelis; columellá leviter contortá.

Shell fusiform, rather narrow, presenting somewhat of the appearance of two cones placed base to base, transversely furrowed and banded, but with the surface smooth and shining: the spire, formed of seven or eight volutions, is elevated, equalling the aperture in length. The whorls are obtusely angulated at the shoulders, round which, in the very young state, they present a series of regular, closely set, long, narrow, vertical plications, which gradually become more and more faint as the shell is enlarged, and ultimately disappear on the fourth or fifth whorl, after

which the shoulders are without ornament; the sides of the whorls in front of the shoulders are very nearly straight; the posterior margins slope gently backwards, and are very slightly channelled. The sutural edge presents either a single, sharp, ridge-like line, or, more generally, two sharp and very slender, raised lines, separated by a concave furrow; in the early whorls it is strongly crenulated, but the crenulations afterwards become faint and almost obsolete; the hollow space between the margin and the shoulder, and the shoulders themselves in the later whorls, are smooth and shining. The concentric bands are depressed, more or less broad in different specimens, and separated by rather deep, concave furrows, which are frequently traversed by a single, very fine, raised line. The last whorl, which is nearly conical, is slightly notched at the base and feebly crested in front. The aperture is narrow, long, and sub-quadrate, and terminates in front in a wide, short, indistinct canal; the outer lip is moderately arched, thin-edged, and smooth within; the sinus is wide and deep, with nearly parallel margins, and is placed on the shoulder; and the columella is cylindrical and very slightly twisted.

This *Pleurotoma* has a close analogy with *P. turbida*, for which, in the young state, it may be mistaken; but the greater narrowness, and the smooth, shining surface, of the shell, the more conical form as well of the spire as of the body whorl, the unornamented shoulders of the later whorls, and the narrow, subquadrate aperture, sufficiently distinguish it from that species.

Size.—Axis, 1 inch and 2-12ths, nearly; diameter, rather more than 5-12ths of an inch.

Locality.—Alum Bay (Stratum No. 29, Prestw.)

No. 240. *PLEUROTOMA HANTONIENSIS*. *F. E. Edwards*. Tab. XXXI, fig. 8, *a—c*.

PLEUROTOMA PLEBEIA, var. *b*. *Forbes*. 1856. Tert. fluvio-mar. form., &c. (Mem. Geol. Surv.), p. 154, t. 5, f. 2.

P. testá turritá, transversim lineis elevatis crassis cinctá: spirá acuminatá: anfractibus depresso-convexis, carinâ obtusâ, nodoso-crenatâ, bipartitis: marginibus posticis sub-depressis, excavatis, transversim exilissime lineatis, ad saturam crenulatis; ultimo anfractu antice valde coarctato, in canalem patulum, ad extremitatem emarginatum, producto; lineis transversis supra medias partes anfractuum crassis, præminentibus, sub-distantibus, irregularibus; interstitiis sæpe exiliter lineatis: aperturâ oblongo-ovali; labro tenui, simplici, valde arcuato: columellâ contortâ, obscure callosâ; sinu latiusculo, triangulari, ad carinam collocato.

Shell turreted, concentrically and coarsely lined: spire pointed, elevated, a little exceeding the aperture in length. The whorls, eight or nine exclusive of a smooth, conical pullus, are depressedly convex, divided unequally at the shoulder by an obtuse

keel, bearing a row of moderately distant, nodulous tubercles; the posterior margins are depressed, concave, bordered round the suture by two sharp, elevated lines, crenulated by the lines of growth; the hollow space between these lines and the shoulder is traversed by numerous very slender lines, so fine as scarcely to be visible without the aid of a magnifying glass or to detract from the otherwise smooth aspect of the surface; the concentric lines over the middle of the whorls are very prominent, thick, cord-like, rather distant, and irregular; two or three fine, thread-like lines very often appear in the intervening spaces. The last whorl is much contracted towards the front, and terminates in a short, distinct, and very wide canal, rather deeply notched at the anterior extremity. The aperture is of an elongated, oval form; the outer lip much arched, thin and sharp on the edge, and smooth within; the sinus, which is placed on the keel, is very wide, moderately deep, and triangular in shape; and the columella is slightly twisted, and presents about the middle a very obscure callus, and at the anterior extremity the crest, which usually accompanies a well-defined, anterior notch.

This *Pleurotoma* is, as Professor E. Forbes (*loc. cit.*) has observed, much thicker, wider, and larger than *P. plebeia (denticula)*, of which, nevertheless, from an assumed identity of sculpture in all essential points in both shells, that author considered it to be merely a variety. In this opinion I cannot concur. Without attaching too much weight to the great differences in the size and relative proportions of the two shells, although, when associated with other distinctions, these are not without importance, it will be seen that, in fact, the sculpture is not identical with that of *P. denticula*, and that there are other dissimilarities sufficient to separate the present *Pleurotoma* from that species. With regard to the crenulation on the shoulders of the whorls, that character is due, as before observed, to the thickening of the shell at the extremity of the sinus, and a greater or less similarity in that ornament must necessarily prevail in all the species forming the group to which the *Pleurotomæ* in question belong; but in this species, the crenulations are more transversely oblong and nodulous than those which characterise the upper Eocene forms of *P. denticula*; the spire also is more pointed and shorter, the posterior margins more depressed, the transverse lineation much more coarse and prominent, and the anterior canal shorter and wider, and deeply notched at the extremity. On these grounds, therefore, I have separated the present species from *P. denticula*, although I have much hesitation in dissenting from the opinion of Professor E. Forbes. I may add that I possess a series of each form from the same locality, Lyndhurst, in which the distinguishing characters of the two species are constantly maintained, without the occurrence of any intermediate form.

Size.—Axis, 1 inch and 8-12ths; diameter, 8-12ths of an inch.

Localities.—Brockenhurst, Lyndhurst, Roydon, and Whitecliff Bay (fide Forbes).

No. 241. PLEUROTOMA ZONULATA. *F. E. Edwards.* Tab. XXXII, fig. 6, *a, b.*

P. testá parvâ, elongato-fusiformi, sub-turritâ, omnino concentricè lineatâ: anfractibus depresso-concavis; marginibus posticis sulcatis; ultimo anfractu sub-conico, in canali lato brevi terminato; lineis concentricis crassiusculis, per-elevatis, sub-distantibus: aperturâ ovali; labro sub-recto, acuto, intûs plicato; sinu lato, profundo, sub-trigono, ad humerum collocato.

Shell small, elongate, fusiform, and concentrically lined; the spire is elevated, exceeding the aperture in length, and somewhat turreted; the whorls are flatly convex, and furrowed round the posterior margins, the sutural edge of which is bordered by a single prominent line; the last whorl is nearly conical, and terminates, anteriorly, in a very wide, short, but distinct and oblique, canal; the concentric lines are rather thick, much elevated, moderately distant, and nearly equal over the whole surface. The aperture is of a widely ovate form; the outer lip nearly straight, thin and sharp on the edge, and plicated within; the sinus is placed on the shoulder, and is very wide, deep, and sub-trigonal in shape, with a much-rounded apex; and the columella is slightly twisted.

A very pretty and somewhat rare shell, the prominent and nearly equal transverse lincation of which gives to it a screw-like appearance. It appears to be quite distinct.

Size.—Axis, 4-12ths of an inch; diameter, 1-8th of an inch.

Localities.—Highcliff, Barton, Alum Bay (Stratum, No. 29, Prestw.)

No. 242. PLEUROTOMA CONOIDES. *Solander.** Tab. XXXIII, fig. 5, *a, b.*

MUREX CONOIDES. *Sol.* 1766. Brand., Foss. Hanton, p. 14, fig. 17.

— — *Morr.* 1854. Cat. Brit. Foss., p. 270.

Non. PLEUROTOMA CONOIDEA. *Nyst,* 1843. Descr. des coq., &c., de Belg., p. 515, t. 40, fig. 9.

P. testâ utrinque sub-conicâ, sub-turritâ, longitudinaliter denticulato-plicatâ, concentricè lineatâ: spirâ elevatâ, acuminatâ; anfractibus ad humeros uente angulatis, marginibus posticis declivis, valde caratis, ad suturam unicâ lineâ, aliquando fastigiiformi, aliquando

* The descriptions of this and the following two species, *P. biconus* and *P. helicoides*, have been, accidentally, misplaced; the species form part of the first section, in which the sinus is placed in the margin of the whorls.

denticulatá, cinctis, cæterum lævibus; ultimo anfractu conico, antice in canali patulo indistincto, terminato, ad basin emarginato: aperturá angustá, sub-quadratá; labro arcuato, acuto, intús plicato; sinu latiusculo, sub-semicirculari, in margine collocato.

Shell fusiform, somewhat turreted, longitudinally plicated, and transversely lined; the spire conical, pointed, elevated, forming rather more than half of the shell. The whorls are sharply angulated at the shoulders; the posterior margins slope gently backwards; they are deeply channelled, and are bordered round the suture by an elevated line, which, in some specimens, is sharp and ridge-like, in others denticulated; the hollow space between this line and the shoulders is smooth; the last whorl is nearly conical, and terminates in front in a wide, indistinct canal, slightly emarginate at the extremity; this form of the body whorl, with the conical spire, imparts to the shell the appearance of two cones placed base to base. The longitudinal plications, which extend to the very base of the shell, are numerous, narrow, oblique, curved, and thickened at the points, where they are crossed by the transverse lines, into small, tooth-like tubercles; the transverse lines are moderately distant and sharp. The aperture is very narrow and subquadrate, resembling that of the cones; the outer lip is moderately arched, sharp-edged, and strongly plicated within; the sinus, which is placed in the margin, is rather wide and nearly semicircular.

Some shells from Lethen and Vliermael have been referred by Nyst to this species, although with doubt; judging from the figure given by that author, the margins of the whorls in those shells appear to be narrower, and the longitudinal plications thicker and less numerous, than in this species, and the body whorl is convex, contracted in front, and terminates in a perspicuous canal; the shells in question are, in fact, quite distinct from the "*testa caudata, utrinque sub-conica*," described by Solander, and D'Orbigny has distinguished them as *P. sub-conoides*.

Size.—Axis, 9-12ths of an inch; diameter, nearly 4-12ths of an inch.

Localities.—Barton, Highcliff, Alum Bay (No. 29, Prestwich).

NO. 243. *PLEUROTOMA BICONUS*. *F. E. Edwards*. Tab. XXXIII, fig. 7, a, b.

P. testá biconicá, concentrice lineatá: spirá sub-turritá, acuminatá: anfractibus ad haucos angulatis, granoso-tuberculatis; postice cavatis, ad suturam lineá fastigiiformi cinctis, cæterum lævibus; antice sub-rectis: lineis concentricis elevatis, acutis, sub-distantibus, interstitiis concavis: aperturá angusto-ovali, in canali patulo indistincto exente; labro leviter arcuato, acuto, intús plicato; sinu lato, breviusculo, sub-trigono, in margine collocato.

Shell doubly cone-shaped and concentrically lined; the spire, which is a little shorter than the aperture, is somewhat turreted and pointed. The whorls, five or six without the pullus, are rather sharply angulated at the shoulders, which present

a series of very small, closely set, regular, rounded tubercles, frequently lost on the last whorl of the adult shell; the posterior margins are channelled and bordered round the suture by a single elevated, sharp, ridge-like line, the space between which and the suture is smooth; the body whorl is nearly straight-sided, and tapers gradually towards the front, assuming a nearly conical shape, and it terminates in a wide and indistinct canal, slightly notched at the extremity. The aperture is narrow, and of an oblong-oval shape; the outer lip very slightly arched, thin and sharp on the edge, and plicated within; and the sinus, which is wide, very shallow, and sub-triangular in form, is placed in the margin of the whorl.

This *Pleurotoma*, in its general aspect, presents a very close analogy with *P. conoides*, of which, on a cursory inspection, it might be regarded as a variety merely. It is, however, a broader shell, the spire is not so much produced, and the sculpture consists of simple, transverse lineation, without the denticulated, longitudinal plication which distinguishes that species; the outer lip also is much less arched, and the sinus is wider, shallower, and more triangular.

Size.—Axis, 7-12ths of an inch; diameter, 3-12ths of an inch.

Locality.—Highcliff.

No. 244. *PLEUROTOMA HELICOIDES*. *F. E. Edwards*. Tab. XXXII, fig. 7, *a*, *b*.

PLEUROTOMA TURRELLA. *Morr.* 1854. *Cat. Brit. Foss.*, p. 270 (non *Lam.*).

P. testá elongato-fusiformi, angustá, transversim lineatá: spirá elevatá, sub-conicá, acuminatá: anfractibus numerosis, ad humeros et prope suturam bi-carinatis; marginibus posticis latiusculis, paululo declivis, sub-rectis; ultimo anfractu brevi, convexiusculo, in canali patulo indistincto exeunte, ad extremitatem profunde emarginato; lineis transversis omnino lineis incrementi eleganter clathratis; suprá margines posticas crebis, exilissimis, regularibus; cæterum elevatis, acutis, irregularibus: aperturá angusto-ovali; labro arcuato; sinu lato, brevi, triangulari, anticá in margine collocato.

Shell long, narrow, fusiform, transversely lined: the spire nearly conical, pointed, and much elevated, being almost twice the length of the aperture. The whorls, nine or ten in number, present a narrow, elevated keel round the shoulders, and a sharp, raised, ridge-like line, like a second keel, round the edge of the whorls, at a little distance from the suture; these keels give to the spire a screw-like appearance: in the early whorls the keel on the shoulders is transversely denticulated. The posterior margins, which slope but slightly backwards, are wide, covering the preceding whorl up to the shoulder, and are very obscurely channelled, almost straight; the last whorl is short, convex, and produced in front into a wide and somewhat indistinct canal, deeply notched at the extremity. The concentric lines over the margins are rather

close-set, regular, and very slender; over the middle and front parts of the whorls they are sharp, rather distant, unequal and irregular, slender and slightly raised lines alternating with other lines thicker and more prominent; all are beautifully decussated by the prominent lines of growth. The aperture is of a narrow, oval form; the outer lip moderately arched, thin and sharp on the edge, and smooth within; the sinus, which is wide, short, and triangular, is placed in the front of the margin, the apex being immediately behind the keel; and the columella is slightly twisted, and crested in front. In the specimens from Highcliff the shell is comparatively wider, with a shorter spire, but the sculpture is identical.

This *Pleurotoma* presents a close resemblance to *P. turrella* (Lamk.) from the Calcaire Grossier, with which, in fact, I had formerly associated it; but a careful examination of a larger series of specimens than I then possessed has induced me to change that opinion. In the French species the shell is smaller, the spire much less produced, the whorls more convex, the posterior margins more slanting, the body whorl more conical, the keel on the shoulder not so prominent, the transverse lineation more crowded and less bold and decided in character, and the sinus narrower, deeper, and placed in the middle of the margin. The English shells present altogether a character so distinct, that I am unwilling to regard them even as varieties of Lamarck's species.

Size.—Axis, 15-24ths of an inch (16 millim.); diameter, not quite 5-24ths (5 millim.).

Localities.—Barton and Highcliff, at both of which places it is somewhat rare, but rather less so at the latter locality.

Section II.—*Shells coniform.*

No. 245. *PLEUROTOMA PRISCA*. *Solander*. Tab. XXXIII, fig. 1, *a—e*.

MUREX PRISCUS. *Sol.* 1766. Brander, Foss. Hanton, p. 16, f. 25 and 44.

PLEUROTOMA CLAVICULARIS. *Lamk.* 1802. Ann. du Mus., vol. iii, p. 165, No. 3.

— — *Roissy*, 1804. Buffon, Moll., vol. vi, p. 73.

— — *Lamk.* 1816. Tab. Encyclop. et Méthod., t. 440, f. 4.

— — *Lamk.* 1822. Anim. sans Vert., vol. vii, p. 98.

— *PRISCUS*. *Sow.* 1823. Min. Con., vol. iv, p. 119, t. 386.

— *CLAVICULARIS*. *Brongn.* 1823. Terr. tert. du Vicent., p. 73.

— — *De Blainv.* 1826. Dict. des Sci. nat., vol. xli, p. 388.

— *PRISCA*. *De Blainv.* 1826. Idem.

— — *Bronn*, 1831. Ital. Tertiärgeb., p. 47, No. 321.

- PLEUROTOMA CLAVICULARIS. *Desh.* 1832. *Encyclop. Méthod. (Vers.)*, vol. iii, p. 796, No. 12.
- — *Desh.* 1824-37. *Coq. foss., &c., de Paris*, vol. ii, p. 437, t. 69, f. 9, 10, and 15-18.
- PRISCA. *Desh.* 1824-37. *Idem*, vol. ii, p. 436, t. 69, f. 1, 2.
- CLAVICULARE. *Phil.* 1846. *Tert. foss. Magdeburg*, p. 63, No. 113.
- CLAVICULARIS. *Bronn*, 1848. *Index Palæontol.*, p. 1002.
- PRISCA. *Bronn*, 1848. *Idem*, p. 1008.
- CLAVICULARIS. *Rouault*, 1848. *Foss. du terr. éoc., &c., de Pau (Mém. Soc. Géol. de France, 2d ser., vol. iii, p. 481)*, No. 83.
- PRISCA. *Sow.* 1850. *Dixon's Geol., &c., of Sussex*, p. 102, t. 7, fig. 24; and p. 119, t. 14, fig. 30.
- — *Bell.* 1851. *Foss. Nummul. du Comté de Nice (Mém. Soc. Géol. de France, 2d ser., vol. iv, p. 222)*, No. 86.
- CLAVICULARIS. *Bell.* 1851. *Idem*, No. 87.
- — *D'Orb.* 1852. *Prod. de Paléontol.*, vol. iii, p. 359; 25^e Etage; Parisien, A, No. 404.
- PRISCA. *D'Orb.* 1852. *Idem*, vol. iii, p. 416; 25^e Etage; Parisien, B, No. 1475.
- CLAVICULARIS. *Nyst.* 1836. *Coq. foss. de Hoesselt, &c.*, p. 31, No. 79.

P. testá elongato-fusiformi, sub-glabrá: spirá elatá, sub-conicá, acuminatá: anfractibus ventricosi, postice lineato-marginatis, ad basin transversim sulcatis, cæterum lævibus: ultimo anfractu in canali lato, indistincto, exeunte, ad extremitatem sub-profunde emarginato: aperturá oblongo-ovali; labro aliformi, tenui, acuto; sinu lato, breviusculo, sub-trigono, anticam in marginem collocato; labio antice incrassato, reflexo: columellá leviter contortá, antice cristatá.

Shell elongated, fusiform, nearly smooth; the spire almost conical, pointed, and moderately elevated, being of equal length with the aperture. The whorls are slightly ventricose; when young, the whole surface is covered with moderately distant, concentric, raised lines, in which state it resembles *P. filosa* (Lamk.); these lines, however, are lost on the fourth or fifth volution, and the whorls afterwards become smooth and shining, except at the base and over the posterior margins, round the sutural edges of which last run three or four fine threadlike, raised lines, occasionally replaced by two or three shallow, obscure furrows; the last whorl is nearly conical, obscurely sulcated at the base and deeply notched at the extremity; the anterior canal is wide, very short, and indistinct. The aperture is narrow and of an oblong-oval form; the outer lip wing-shaped, projecting towards the front, thin and sharp on the edge, and smooth within; the sinus, which is in the very front of the margin, is wide, moderately deep, somewhat triangular in form, and widely rounded at the extremity; the inner lip is much thickened, and is produced and bent outwards in front, giving an umbilicated appearance to the columella, which is slightly twisted and prominently crested towards the base.

It appears to me to be impossible, satisfactorily, to separate *P. clavicularis* from

the *P. prisca* of Solander. It is true that in Lamarck's species the shell is smaller and narrower, the spire more tapering, the whorls not so ventricose, and the sinus rather wider and shallower; but whether these differences, even when constant, are by themselves of specific value may be questionable: and it must be stated that the English shells are variable in the length of the spire and the condition of the whorls, which, in some specimens, are less convex than in others, and, in fact, I have, in my collection, a Barton specimen which, so far as the proportions and shape of the shell may be relied on, cannot be regarded as specifically distinct from *P. clavicularis*. The only distinction to which, apparently, any consideration is due, lies in the condition of the sinus. In the shell figured by Deshayes as *P. prisca*, the sinus is represented as placed in the front of the margin with the apex almost on the shoulder, and as being deep and rather narrow, with nearly parallel margins; now, this does not correspond with the sinus in Solander's species, which, although similarly placed, is intermediate in form between the sinus in *P. prisca* of Deshayes and that in *P. clavicularis*. I have already suggested that the sinus may be, reasonably, expected to be liable to variation in its dimensions, and too much importance, therefore, must not be attributed to mere differences in size and proportion. On these grounds, I have, notwithstanding the array of authorities against me, considered *P. clavicularis* of Lamarck as merely a variety of Solander's species.

Size.—Axis, 2 inches and 11-12ths (74 millim.); diameter, 11-12ths of an inch (23 millim.) The specimen represented by fig. 1 *d*, is upwards of 3 inches in length; but the body of the shell having been twice broken and repaired by the animal, the diameter cannot be accurately stated.

Localities.—Barton, Highcliff, Bramshaw, Stubbington, Bracklesham Bay. *French*: Grignon, Parnes, Mouchy, Courtagnon, Valmondois, Ancy, Tanerou (fide Desh.), Cuisse-Lamotte, Marquemont, Saint Félix, Gomerfontaine, Les Groux, Hermes, Châteaurouge, Mouy, Monneville, Neuvillebosc (fide Graves), Bos d'Arros (fide Rouault). *Italian*: Palarea (Nice), (fide Bellardi), Montecchio-Maggiore on the Vicentin (fide Brongniart).

No. 246. *PLEUROTOMA AMPHICONUS*. *Sow.* Tab. XXXIII, fig. 2, *a*, *b*.

PLEUROTOMA AMPHICONUS. *Sow.* 1850. *Dixon's Geol., &c., Sussex*, p. 183, t. 8, f. 7 and 8.

P. testá glabrá, angulo obtuso inæqualiter bipartitá, utrinque conicá; anfractibus postice et antice undulato-sulcatis, cæterum lævibus: aperturá angustá, marginibus sub-parallelis, in canalem brevem, ad extremitatem profunde emarginatum, productá; labro arcuato, ad humerum late breviterque sinuato; labio antice producto, reflexo; columellá cristatá.

Shell nearly smooth, obtusely angulated at the shoulders, presenting the appearance

of two unequal cones placed base to base, the smaller one of which is represented by the spire; the whorls, seven or eight without the pullus, are straight on the sides and taper regularly towards the base; the posterior margins slope gently backwards, concealing the preceding whorl up to the angle of the shoulder, giving a straight-sided, conical shape to the spire, which forms about two fifths of the entire length of the shell. Two or three narrow, obscure furrows traverse the space between the suture and the shoulders; and the front of the last whorl also presents numerous transverse, undulating furrows, the ridges between which are a little roughened by the lines of growth; the remaining surface of the whorls is smooth and shining. The aperture is long and narrow, with nearly parallel margins, resembling that of a *Cone*, and terminates in front in a wide, short, and indistinct canal, deeply notched at the anterior extremity. The outer lip is much arched, and presents on the shoulder a very wide, shallow sinus, with a broadly rounded apex; the inner lip is elevated and bent outwards at the base, giving an umbilicated appearance to the front of the shell; and the columella is cylindrical and strongly crested.

The present species is distinguished by the inequality of the two cones of which it appears to be formed, and by that character and by the wide, shallow sinus it may be easily separated from *P. prisca*, which, in other respects, it resembles. It does not appear to have an analogue among the French coniform *Pleurotomæ*.

Size.—Axis, $2\frac{1}{2}$ inches; diameter, 1 inch.

Locality.—Bracklesham Bay, to which it appears to be peculiar. I have not met with it elsewhere, not even at Stubbington or Bramshaw.

No. 247. *PLEUROTOMA SEMISTRIATA*. *Deshayes*. Tab. XXXIII, fig. 3 *a*, 3 *b*.

PLEUROTOMA SEMISTRIATA. *Desh.* 1824-37. Desc. des Coq. foss., &c., vol. ii, p. 443, t. 69, figs. 5, 6.

Non *PLEUROTOMA SEMISTRIATA*. *Partsch.* 1837. v. Hauer. Vorkomm. foss. Thierr. tert. Beck. v. Wien; Jahrb., p. 419, No. 107.

P. testá biconicá, transversim obsolete lineatá; spirá elatá, acuminatá; anfractibus convexiusculis, postice obsolete sulcatis; ultimo anfractu gradatim attenuato, conoideo, concentrice distanter et exilissime lineato, antice transversim sulcato, ad basin sub-profundè emarginato: aperturá elongato-angustá; labro acuto, aliforme, arcuato; sinu lato, triangulari, in margine collocato.

Shell elongated, fusiform, tapering gradually towards each extremity and presenting the appearance of two cones placed base to base; the spire moderately elevated, nearly equalling the last whorl in length, and pointed. The whorls, seven without the pullus, are slightly convex, smooth and shining; the posterior margins, which slope gently backwards, present two or three very shallow, nearly obsolete, concentric furrows; the last

whorl is obscurely angulated at the shoulder, and tapers gradually and equally towards the base; it presents, in front, several shallow, obliquely transverse furrows, which become more and more feeble as they ascend towards the middle of the whorl, where they are replaced by some distant, very slender, scarcely perceptible, raised lines; the anterior canal is wide, indistinct, and rather deeply notched at the extremity. The aperture is of a long, narrow, oval shape; the outer lip much arched, projecting a little towards the anterior extremity; the sinus, which is placed in the margin, is wide, moderately deep, and triangular in form; the columella is cylindrical and slightly oblique; and the columellar lip is elevated and bent outwards, imparting somewhat of an umbilicated character to the base of the shell.

Although presenting a close analogy with *P. prisca*, this *Pleurotoma* is more symmetrical in its outline; the last whorl is more regularly conical, and the sinus wider, shallower, and more trigonal; these differences and the delicate, transverse lineation, confined to the middle and upper parts of the whorls, apparently separate the present species from Solander's.

The shells from Baden, to which Partsch gave the specific name *semistriata*, are fusiform, costellated shells, sharply angulated at the shoulders, and having depressed, concave margins; they are referred to by D'Orbigny, in his 'Prodrome,' as *P. sub-semistriata*, while some shells from Tortona, which Bellardi has regarded as also belonging to Partsch's species, have been named by him *P. Lamarcki*.

Size.—Of the specimen figured, axis, rather more than 11-12ths of an inch, (24 millim.); diameter, 4-12ths of an inch (9 millim.)

Localities.—Bramshaw. *French*: Parnes, Mouchy (fide Deshayes), Gomerfontaine, Gypsevil, Amblainville, Chateaurouge, Hermes, Saint Félix, Acy-en-Mulcien (fide Graves).

No. 248. *PLEUROTOMA GLABRATA*. *Lamarck*. Tab. XXXIII, fig. 4.

PLEUROTOMA GLABRATA. *Lamk.* 1802. Ann. du Mus., vol. iii, p. 184, No. 4.

— — *Lamk.* 1822. Anim. sans Vert., &c., vol. vii, p. 98, No. 9.

— — *Desh.* 1824-37. Descr. des Coq. foss., &c., vol. ii, p. 439, t. 69, f. 7, 8.

P. testá utrinque sub-conicá, sub-turritá, glabrá: spirá acuminatá, ultimo anfractu breviori: anfractibus convexiusculis, obtuse angulatis; marginibus posticis angustis, cavatis, concentricè lineatis; ultimo anfractu antice transversim sulcato, ad basin emarginato: aperturá elongato-angustá; labro tenui, dilatato; labio antice producto, reflexo; columellá cylindraceá, cristatá: sinu lato, brevissimo, in margine collocato.

Shell doubly conical, somewhat turreted, nearly smooth; the spire pointed, moderately elevated, forming nearly two fifths of the whole length. The whorls, eight or nine

without the pullus, are slightly convex and bluntly angulated at the shoulders ; the posterior margins are narrow, rather deeply channelled, very finely plicated round the suture, and ornamented with several transverse raised lines, of which the one nearest the edge is the most prominent ; the whorls in front of the shoulders are smooth ; the last whorl tapers gradually towards the base, and is nearly conical, and over the front part presents numerous transverse furrows, which become gradually obsolete as they mount towards the middle of the whorl ; the anterior canal is wide, indistinct, and notched at the extremity. The aperture is long, narrow, with straight, nearly parallel sides, and, like that of *P. amphiconus*, resembles the aperture of a *Cone* ; the outer lip is much expanded, approaching nearly to a semicircle in form, and is thin and sharp-edged ; the columellar lip is thickened and produced in front ; the columella is nearly cylindrical, and presents a prominent ridge or crest at the anterior extremity ; and the sinus, which is placed in the margin of the whorl, is wide, but very shallow, resembling in appearance that which characterises Bellardi's section, *Pseudotoma*.

I possess only one specimen of this *Pleurotoma* ; it has attained a larger size than that attributed by Deshayes to the French shells, but the relative proportions are the same in both. The transverse furrows over the base of the English shell are coarser, and extend higher up the whorl than in the French shells, but in other respects, and particularly in the narrow, concave, posterior margins of the whorls and the peculiar character of the sinus, the two agree.

Size.—Axis, 1 inch and 9-12ths (45 millim. nearly) ; diameter, 9-12ths of an inch (19 millim.)

Localities.—Bracklesham Bay, where it is very rare. *French* : Grignon, Parnes, Mouchy (fide Desh.), Chaumont, Lattainville, Gomerfontaine, Mouy, Saint-Félix, Uilly-Saint-Georges, La Croix blanche near Chambors (fide Graves).

Genus 27th. *BORSONIA*. *Bellardi*, 1837.

CORDIERIA. *Rouault*, 1848.

Among the fossil shells found in the Miocene beds of Turin, occurs one species possessing all the general characters of *Pleurotoma*, that is to say, an elevated, pointed spire, a lengthened straight anterior canal, and a wide semicircular sinus, placed in the depressed posterior margin of the whorl, but distinguished from the true *Pleurotoma* by the presence of a single fold on the columella ; and Bellardi, influenced by the importance generally attributed to the presence or absence of undoubted folds on the columella, was induced to establish the present genus for the reception of the species in question. It has been seen that among the English *Pleurotomæ* before described are

several, the columellæ of which present an oblique, obscure, fold-like callus, similar to that which characterises the columella of *P. cataphracta* (Brocc.) and *P. Delucii* (Nyst.); but in these instances the character is due to a callosity occasioned by the contortion of the columella. The fold presented by Bellardi's species (*Borsonia prima*) is nearly transverse, sharp, and well defined, and appears to be a true columellar fold, quite distinct in character from the callosity to which I have referred. That author, therefore, in defining his genus, has carefully excluded those species which present merely a callus-like prominence, distinct from and not to be confounded with the elevated and clearly defined fold, characteristic of *Borsonia*.

Subsequently other Pleurotomoid shells, from the Eocene formations in the environs of Pau, were noticed by M. Rouault, on the columella of which two or three folds were found; and that author, misapprehending apparently the true character of the fold in *Borsonia*, which he says appears to be only a small ridge on the left margin, and not a part of the columella, proposed the genus *Cordieria* for such Pleurotomoid shells as possessed two folds or more on the columella. The careful manner in which Bellardi has restricted the character of the fold in *Borsonia*, and the absolute want of any distinct generic value in the presence of one or more additional folds, appear to render the further division of the group proposed by Rouault unnecessary.

The genus *Borsonia* is not admitted by D'Orbigny; but, without entering into the question whether and under what conditions the presence or absence of clearly defined folds on the columella is to be regarded of generic value, it is convenient, at all events for the present, to retain *Borsonia* as a well-marked section of a genus already overcrowded with species.*

Two representatives of the genus are found still living, both inhabitants of tropical seas. In addition to the species noticed by Bellardi, three other *Borsoniæ* from Biarritz and Bos d'Arros, in the neighbourhood of Pau, have been recorded by Rouault. With one of these (*B. Biarritzana*), a species from the middle Eocene beds in England, described by Sowerby as *Pleurotoma curvica* in Dixon's 'Geology' &c., of Sussex, corresponds so closely that I have not ventured to retain it as distinct. Certain shells from Grignon and Parnes, described by Deshayes as *Pleurotoma nodularis*, present two folds on the columella, and will therefore belong to the present genus; and the description of a sixth species (*Borsonia sulcata*), from the upper Eocene beds, has also been given in Professor E. Forbes's memoir on the tertiary fluviomarine of the Isle of Wight. To these two more species are now added.

* The genus in question establishes a passage between *Pleurotoma* and *Fasciolaria*, or rather *Turbinella*, the folds being higher up the columella and more transverse than those of *Fasciolaria*, and approaching more nearly in position and character to those of *Turbinella*.

No. 249. BORSONIA BIARITZANA. Rouault. Tab. XXXIII, fig. 11, *a*, *b*.

BORSONIA BIARITZANA. Rou. 1848. Bull. de la Soc. Géol. de France, 2^e série, vol. v, p. 207.

— PALENSIS. Rou. 1848. Idem.

CORDIERIA BIARITZANA. Rou. 1848. Desc. des Foss. du terr. Eocene, des Env. de Pau (Mem. Soc. Géol. de France, 2d series, vol. iii, p. 488, tab. 17, fig. 5, *a*, 6, *a*).

PLEUROTOMA CURVICOSTA. Sow. (non Lamk.) 1850. Dixon's Geol., &c., Sussex, p. 183, tab. 7, fig. 17.

— — Morris, 1854. Cat. Brit. Foss., p. 270.

FASCIOLARIA BIPPLICATA. Sow. 1850. Dixon's Geol., &c., Sussex, p. 184, t. 5, fig. 7.

— — Morris, 1854. Cat. Brit. Foss., p. 248.

B. testá elongato-fusiformi, turritá, longitudinaliter nodoso-costatá, spiraliter lineatá: spirá acuminatá, elevatá, in longitudine aperturam paullo superanti: anfractibus convexis, postice canaliculatis; costis latis, rotundatis, brevibus; lineis spiralibus crebris, filiformibus: aperturá oblongo-ovatá, antice in canali lato brevique excavate; labro sub-recto, in margine sinuato; sinu lato, mediocriter profundo, semicirculari; columellá sub-cylindricá, biplicatá.

Shell elongated, fusiform, ribbed, and spirally lined; the spire pointed and elevated, somewhat exceeding the aperture in length. The whorls, eight or ten without the pullus, are convex, and bluntly angulated at the shoulders, and the posterior margins slope gently backwards and are concentrically furrowed. The longitudinal ribs are distant, very broad, rounded, and somewhat swelled, so as to become almost nodulous, on the shoulder; the concentric lines are numerous and thread-like, even and regular on the posterior margins and shoulders of the whorls; elsewhere they are unequal, more prominent lines alternating with the slender lines, and all are more or less strongly decussated by the lines of growth. The aperture is of an oblong ovate form, and terminates in front in a very wide and short, but distinct, canal; the outer lip is nearly straight, and presents a wide but not very deep sinus, placed in the posterior margin of the whorl; the columella is somewhat cylindrical and nearly straight, and presents, a little behind the middle, two slightly oblique, narrow folds, which do not extend to the front of the columella, and which, consequently, are scarcely visible unless the outer lip is broken off.

The specimen figured and described by Mr. Sowerby (loc. cit.) as *P. curvicosta*, forms part of my collection; at that time the aperture was closed by the matrix, and the columellar folds, therefore, were not detected. These folds have since been exposed to view, and there cannot be now any doubt of the identity of *Pleurotoma curvicosta* (Sow.) and *Fasciolaria biplicata*.

The shells from Bos d'Arros, described by Rouault, apparently do not attain so large a size as our English shells; in them the last whorl is longer, apparently, than

the spire, one of the transverse lines near the middle is more elevated than the others, and the columella sometimes presents a third fold, much smaller than the other two. In all other respects the shells from the two localities agree perfectly, and the differences do not appear to me to be sufficient to justify their being considered as specifically distinct.

The shells which Rouault, in the first instance, separated under the specific name *Palensis* were subsequently ascertained by that author to be the adult shells of *B. Biaritzana*, and were united by him to that species.

Size.—Axis, 1 inch and 5-12ths; diameter, 7-12ths of an inch, nearly.

Localities.—Bracklesham Bay and Bramshaw, at both of which places it is not uncommon. *French*: Bos d'Arros.

No. 250. *BORSONIA SULCATA*. *F. E. Edwards*. Tab. XXXIII, fig. 12, *a*, *b*.

BORSONIA SULCATA. *Morris*, 1856. *Forbes's Tert. fluvio-mar. Form., &c.*, p. 154, t. 5, fig. 3, 3 *a*, 3 *b*.

B. testá ovato-fusiformi, semi-costatá, transversim sulcatá; spirá sub-turritá, acuminatá: anfractibus convexiusculis; marginibus postices excavatis, ad suturam marginatis, cæterum levibus; costis crassiusculis, rotundatis; sulcis transversis sub-distantibus, irregularibus: aperturá oblongo-ovatá, in canali perbrevis, latissimo, excavante; labro arcuato, postice sinuato. intús plicato; sinu lato, paululum profundo, rotundato: columellá oblique biplicatá, plicis sub-æqualibus.

A small, ovately fusiform shell, longitudinally ribbed and spirally furrowed; the spire, formed of from six to eight volutions, is moderately elevated, rather exceeding the last whorl in length, and is somewhat turreted. The whorls are slightly convex; a deep, smooth furrow runs round the posterior margins, which are bordered round the suture by an elevated, ridge-like line; the last whorl is nearly conical, and terminates in front in a short, but distinct, and very wide canal. The longitudinal ribs are rather broad, very short, not extending beyond the middle of the whorls, and are lost on the last whorl of the mature shell; the spiral furrows are wide, rather deep, concave, somewhat distant, and separated by spaces wider than themselves, and rounded on the upper surface. The aperture is of an oblong-ovate form; the outer lip is moderately arched, sharp on the edge, and plicated within; and it presents, at the posterior extremity, in the marginal furrow, a wide, but not very deep, rounded sinus; and the columella is slightly arched, and bears, about the middle, two nearly equal, moderately oblique folds.

In general aspect this species presents a strong resemblance to *Borsonia* (*Pleurotoma*) *nodularis* (Desh.); but in that species the shell is wider and shorter, and the surface is nearly smooth, except over the canal, which is traversed by a few concentric,

raised lines, so faint as to be scarcely visible to the naked eye; the longitudinal ribs also are thicker and more distant, and they extend to the very front of the whorl.

Size.—Axis, rather more than 6-12ths of an inch; diameter, rather more than 2-12ths of an inch.

Localities.—Headdon Hill, and Colwell Bay, Isle of Wight; and Hordwell.

No. 251. *BORSONIA SEMICOSTATA*. *F. E. Edwards*. Tab. XXXIII, fig. 13, *a*, *b*.

B. testá ovato-fusiformi, semi-costatá, omnino spiraliter lineatá: spirá elatá, turritá. anfractibus convexiusculis, postice canaliculatis; costis numerosis, rotundatis; lineis spiralibus elevatis, acutis, supra margines anfractuum exilibus, regularibus; cæterum irregularibus, sub-distantibus, duabus sub-medianis elatioribus: aperturá oblongo-ovali, in canalem perbreve productá; labro leviter arcuato, postice sinuato, intus lævi; columellæ oblique inequaliter biplicatá, plicá anticá minori.

Shell small, ovately fusiform, longitudinally ribbed, and covered with raised, concentric lines; the spire turreted and elevated, exceeding the aperture in length. The whorls, which are six in number without the pullus, are convex, and channelled round the posterior margins; the last whorl is rather suddenly contracted towards the front, tapering thence gradually towards the base, where it terminates in a very short, wide canal. The ribs are rather numerous, not very broad, rounded on the upper surface of equal thickness, and short, ending abruptly where the whorl contracts; the transverse lines over the posterior margins are very fine, even, and regular; a sharp, elevated line crosses the shoulders, in front of which appear four other elevated lines, which gradually become more and more prominent and distant as they recede from the shoulders; the front two are more prominent and wider apart than the rest; they are separated by a broad, concave furrow, and swelled into small, tooth-like knobs, where they cross the longitudinal ribs; the lines over the front part of the whorl and the canal are irregular and very obscure, almost obsolete. The aperture is of an oblong-oval shape; the outer lip is very slightly arched, and presents a shallow and not very wide, rounded sinus, placed in the marginal depression; the columella is nearly straight, and furnished with two unequal, oblique folds, placed near the middle, the front one of which is the smaller.

In general aspect, this shell so closely resembles *Borsonia sulcata*, that a doubt may fairly be raised whether it ought not to be regarded as a variety of that species. It will be seen, however, on comparison, that in *B. sulcata* the spire is longer, that the posterior margins are not so wide nor so deeply channelled, and that they are spirally lined, and not smooth; that the costæ are narrower and more numerous, and the transverse ornamentation quite distinct in character; that the outer lip is not so

much arched, and is smooth within; and that the columellar folds are more oblique, more unequal, and not so prominent.

Size.—Axis, 4-12ths of an inch; diameter, rather less than 2-12ths of an inch.

Locality.—Barton, where, apparently, it is rare.

No. 252. *BORSONIA LINEATA*. *F. E. Edwards*. Tab. XXXIII, fig. 14, *a*, *b*.

B. testá parvá, ovato-fusiformi, sub-turritá, lineis spiralibus costellisque longitudinalibus sese decussantibus, omnino clathratá: anfractibus convexis, postice sulco concentrico profunde exaratis, ad suturam lineato-marginatis; lineis spiralibus elevatis, irregularibus; costellis numerosis, angustis, pliciformibus, arcuatis: aperturá oblongo-ovali, antice in canali brevi, latiusculo, exeunte; labro sub-recto, postice profunde sinuato, intús plicifero; columellá parum tortuosá, biplicatá.

Shell small, ovately fusiform, sub-turreted, and ornamented with concentric lines and longitudinal ribs, imparting to the surface, by their decussation, the appearance of a fine lattice-work; the spire is of equal length with the aperture, and is rather thick and pointed. The whorls, five or six without the pullus, are convex; the posterior margins slope very gently backwards, and are traversed by a deep, but not very wide, furrow, feebly crenulated; the sutural edge is bordered either by a single, rather thick, elevated line, sometimes granulated, or by a narrow band, formed of two elevated lines, separated by a shallow, but perspicuous furrow; the longitudinal ribs, which are subordinate in character to the concentric lines, are not very prominent, but numerous, narrow, fold-like, oblique, slightly arched, and sharply defined at their posterior extremities by a concentric line, which borders the marginal furrow and gives an angulated appearance to the shoulders; in front of this are two equal, closely set, not very prominent lines, and to these succeed other sharp, equal, transverse lines, which become gradually more distant until they reach the anterior canal, over which the transverse lines again approach more closely. The aperture is of a rather narrow, oblong-oval form, and is produced in front into a short, moderately wide, canal; the outer lip is nearly straight, and presents, at the posterior margin, a deep, semi-elliptical sinus; the columella is slightly twisted, and bears at the middle two oblique and nearly equal folds.

This well-marked species is found at Highcliff; it is somewhat rare.

Size.—Axis, 7-24ths of an inch; diameter, 2-12ths of an inch.

Genus 6th.—*HELIX*. Linné, 1758.

For generic character see *antè*, p. 60.

No. 253. *HELIX MORRISII*, F. E. Edwards, MS., Tab. XXXIV, fig. 5 *a, b*.

Spec. Char. *H. Testá orbiculata, lenticulatá, subdepressá, obsoletè striato-plicatá, ad peripheriam angulatá; spirá brevi; anfractibus quinis convexiusculis, suturá simplici junctis, lente crescentibus; ultimo majore, subtus convexiusculo, lævigato, umbilicato; aperturá paulo obliquá, subquadratá; labro acuto simplici.*

Diameter, $\frac{3}{8}$ ths of an inch.

Locality. Sconce (*Edwards*).

After my plate had been arranged I ascertained that several species of this genus, belonging to the Upper Eocene of the Isle of Wight, which had not been figured by Mr. Edwards, were in his cabinet, and I have been here able to introduce one of these as above referred to, and as Mr. Edwards had probably given to it a careful examination, and satisfied himself that it was a new species, I have much pleasure in adopting the name he has proposed for it.

It slightly resembles a shell from the Lower Tertiaries of France, *H. Heberti*, Deshayes ('An. sans Vert. du Bas. de Par.,' tom. ii, p. 813, pl. lii, figs. 5—7); but, judging from the figure, it appears to possess several differences. M. Deshayes also figured and described a shell ('Desc. de Coq. Foss. des Env. de Par.,' p. 55, pl. vi, fig. 3), to which he gave the name of *H. dubia*, from near Versailles, and he gave for it also the locality of the Isle of Wight; but in his second work, at p. 826, he has doubted the propriety of that statement, and thinks that his shell is an incomplete specimen of *H. Moroguesi*, but the figure of this (*dubia*) more resembles our shell than does any other. Mr. Edwards, he says, has denied the presence of *H. dubia* in our English beds, and I have not the means of making a comparison.

I fear that some of these fossil *Helices* must be carefully compared with the specimens of the foreign species before a perfect identity or non-identity can be relied on; and this I am not able to do. M. Deshayes has not given as a synonym any *Helix* from the English Tertiaries.

FAM.—CYCLOPHORIDÆ.

Genus 28th.—CYCLOSTOMA. *Lamarck*, 1799.

Generic character. “Shell turbinated, thin; axis perforated, aperture oval, peristome continuous, simple or expanded, epidermis thin, operculum shelly paucispiral.”

A large group of land shells have been described under the above generic name, which seem to have only one character in common, viz. a circular mouth, with a thickened, expanded, or reflected peritreme, the shells themselves being some of them nearly cylindrical like *C. flanelum*, or discoidal like *C. planorbulum*; and they have in consequence been separated into numerous proposed genera, depending for those divisions principally, if not entirely, upon the differences in the angle of volution.

Two species from our Eocene deposit at Sconce have been described by Mr. Edwards under one of these divisions, called *Cyclotus*, with a depressedly conical form (see his remarks on the Genus, p. 116 of his work).

No. 254. CYCLOSTOMA? MUMIA, *Lamarck*. Tab. XXXIV, fig. 2 *a—d*.

CYCLOSTOMA MUMIA,	<i>Lamk.</i>	An. du Mus., t. viii, pl. xxxvii, fig. 1 <i>a, b</i> , 1806.
—	—	<i>Desh.</i> Coq. foss. des Env. de Par., p. 76, pl. vii, figs. 1, 2, 1824.
—	—	<i>Id.</i> An. sans Vert. du Bas. de Par., tom. ii, p. 882, 1858.
—	—	<i>Forbes.</i> Mem. Geol. Surv. Isle of Wight, p. 68, 1856.
—	—	<i>Morris.</i> Catal. Brit. Foss., 2nd edit., p. 244, 1854.
—	—	<i>J. W. Lowry.</i> Chart Brit. Tert. Foss., pl. ii, 1866.
MEGALOMASTOMA MUMIA.	<i>Sandberger.</i>	Land- und Süßw.-Conch., p. 217, t. ii, fig. 20, and t. xv, fig. 16 <i>a—c</i> , 1872.

Spec. Char. *C.* “*Testâ cylindraceo-conicâ, transversim striatâ, striis longitudinalibus subtilissimis; aperturâ obliquè ovatâ; labro crasso.*”—*Desh.*

Length, 1 inch; *breadth*, $\frac{3}{8}$ ths of an inch.

Locality. Brading Harbour, *Forbes*. Sconce, *Edwards*.

France, Grignon and numerous other Upper Eocene localities.

This fossil is said to be abundant in some of the numerous localities given for it in the Upper Eocene beds of France. It is at Grignon in association with many marine shells, and it appears to be there of larger dimensions than our own specimens. It has long been known, and its habits have been frequently a subject of discussion from its occurrence with a marine fauna. In this country specimens are not abundant, and all that I have seen are casts. M. Deshayes describes five distinct varieties:

- Var. A. *Testá majore striis transversis numerosioribus.*
 „ B. *Testá striis transversis distantioribus obsoletis; longitudinalibus subnullis.*
 „ C. *Testá lævigatá; labro incrassato.*
 „ D. *Testá tribus lineis rufis pictá.*
 „ E. *Testá angustiore clathratá, striis transversis distantioribus et longitudinalibus raris; labro reflexo, rarè marginato.*

M. Deshayes has given the figure of an operculum of what he considered might belong to this species, but as it was not found in position this is uncertain. The apex of this shell is generally broken in the French specimens, but this probably is accidental; my figures 2 *b, d* are from a specimen in Mr. Edwards' Cabinet, which have the volutions slightly convex; figures 2 *a, c* are made from a fragment in my own cabinet, with more flattened volutions, and the shell of it appears to have been more cylindrical than *Cy. mumia*. This fragment has upon it a few broad spiral striæ, and I thought possibly it might be the cast of some species of *Cylindrella*, a genus not uncommon on the western side of the Atlantic, and for this reason I had it represented, but I now believe it to be only a variety of *C. mumia*, although the cast of a shell represents the volutions as more convex than would the shell itself; the matrix only filling the cavity after the absence of the animal.

Genus 29th.—CALLIA. Gray, 1840.

This genus appears to have been proposed in the year 1840 for a group of the Family Cyclophoridae by Dr. J. E. Gray, when he gave an undescribed species as the type, and it forms another division of a large group of shells once united under the name of *Cyclostoma*. Since then Chenu (p. 490) has thus described the genus:—“*Coquille pupiforme, couverte d'un enduit lisse, brillant. Overture arrondie, un peu déviée, péristome mince opercule mince, membraneux, à tours étroits. C. lubrica, Sowerby, f. 3631-2.*” *Callia* is closely united to *Pupina*, differing from it in not having an open canal at the base of the aperture, which characterises the former genus; and as our shell seems destitute of this canal, I have thought it best to give the only species of this group known to me from the British Eocenes under this generic name, because it has been previously adopted for it, without expressing any opinion of my own as to the propriety of the generic division of the group.

No. 255. CALLIA (?) LEVIS, *F. E. Edwards*, MS. Tab. XXXIV, fig. 3 *a—c*.

PUPINA? LEVIS, *F. Edwards*, MS.

CALLIA? — Sandb. Land- und Süssw.-Conch., p. 298, taf. xvii, fig. 13, 1872.

Height, $\frac{5}{16}$ ths of an inch.

Locality. Sconce (*Edwards*).

This shell has been figured by Sandberger, as above referred to, who says (p. 298), "*Pupina* (?) *lævis*, F. Edwards, in litt. et specim., 1861," but the specimens in Mr. Edwards' cabinet in the British Museum have the name *Cistula lævis* attached. This I mention to prevent confusion hereafter.

Genus 30th.—*POMATIAS*. *Hartmann*, 1821.

This generic name does not appear to be generally adopted, and there is some little confusion respecting it from the great similarity of the two generic names, *Pomatia*, Beck, 1837, a portion of *Helix* (*H. pomatia*?), and *Pomatias*, Hartmann, 1821 (*Cyclostoma patula*). The British Eocene shell having, however, been figured by Sandberger under this generic name, I think it best to retain it so.

No. 256. *POMATIAS LAMELLOSUS*, *F. E. Edwards*, MS. Tab. XXXIV, fig. 4 *a*, *b*.

POMATIAS LAMELLOSUS, *Sandb.* Land- und Süssw.-Conch., p. 299, t. xvii, fig. 14, 1872.
CYCLOSTOMA LAMELLOSUM, *F. E. Edwards*, MS.

Height, $\frac{3}{8}$ ths of an inch.

Locality. Headon Hill (*Edwards*).

This is, I believe, very rare as a British fossil, and I know it only in Mr. Edwards' cabinet, by a specimen from which my figure is taken. That given by Sandberger was also taken from a specimen sent to him by Mr. Edwards.

Genus 7th.—*BULIMUS*. *Scopoli*, 1786.

For generic character see *antè*, p. 71.

No. 257. *BULIMUS RILLYENSIS*?, *Deshayes*. Tab. XXXIV, fig. 9 *a*, *b*.

PUPA RILLYENSIS, *Boissy*. Mém. Soc. Géol. de Fr., 2nd ser., t. iii, p. 273, pl. v, fig. 15, 1848.

— — *Chenu*. Man. de Conch., t. i, p. 443, fig. 3259, 1859.

BULIMUS — *Desh.* An. sans Vert. du Bas. de Par., t. i, p. 830, pl. lv, figs. 3, 4, 1860.

AMPHIDROMUS RILLYENSIS, *Sandberger*. Land- und Süssw.-Conch., p. 152, t. vii, fig. 5, 1871.

Spec. Char. “*B. Testá sinistrorsá, ovato-oblongá, spirá longiusculá, convexá, apice obtuso; anfractibus septenis, sensim crescentibus, vix convexiusculis, suturá planá, lineari junctis, longitudinaliter et obliquè densè striatis, striis æqualibus, regularibus, sublamellosis, ultimo anfractu dimidiam partem testæ æquante obliquè paulo deflexo, basi imperforato; aperturá ovato-semilunari; labro tenui, latè expanso, reflexo.*”—*Desh.*

Height, $1\frac{1}{4}$ inch; *breadth*, $\frac{1}{2}$ inch.

Locality. Britain: Dulwich (*A. Bott*).

France: Rilly (*Deshayes*).

A specimen from which the figure above referred to has been taken is from the cabinet of Mr. Arthur Bott. It is a cast only, the shell having entirely disappeared, but seems to correspond with the French fossil, except that our specimen has the last volution somewhat smaller, and the body is apparently rather larger. Our specimen has, however, been slightly distorted and thrown out of its regular form. The figure by M. Deshayes represents the French shell as being spirally striated; but the disappearance of the exterior of our specimen renders it impossible to say what might have been the ornamentation of the English fossil. I have therefore thought it most prudent to add a note of interrogation to the specific name.

This genus when first proposed contained many hundred species with shells that varied much in outward appearance, some being terrestrial and some aquatic in their habits. It has since been separated into a large number of genera or sections, some of these depending upon differences in the animals which are not available by the palæontologist.

No. 258. *BULIMUS CONVEXUS*, *F. E. Edwards*, MS. Tab. XXXIV, fig. 6.

Spec. Char. *B. Testá elongatá, turritá; anfractibus 6 convexis, suturá depressá, basi convexá, aperturá ovatá, labro acuto, simplici, columellá subreflexá, umbilico parvo.*

Height, $1\frac{1}{4}$ inch; *breadth*, $\frac{7}{8}$ ths nearly.

Locality. Sconce (*Edwards*).

A fine specimen with the above name is in Mr. Edwards' collection, and I know of no species with which it can be identified or even to which it presents a close approximation. I have adopted the name given to it by Mr. Edwards.

The nearest fossil with which I can compare it is *Bulimus mirus*, *Desh.*, but our shell differs so materially from the figure given of this species that it is scarcely necessary to mention their possible connection. The French shell, however, is the nearest ally I can find, and I mention it only for the purpose of comparison when the two shells of each species can be placed together.

No. 259. *BULIMUS?* (*POMATIAS?*) *VECTIENSIS*, *F. E. Edwards*. Tab. XXXIV, fig. 7 *a, b*.

Spec. Char. *B. Testá elongato-conicá, spirá elevatá, apice acuminato; anfractibus septenis subplanis, lente crescentibus, suturá distinctá, basi subangulatá, aperturá obliquá; labro acuto simplici.*

Height, $\frac{5}{16}$ ths of an inch; *breadth*, $\frac{3}{16}$ ths of an inch.

Locality. Sconce (*Edwards*).

This is another fossil from that rich locality in the Isle of Wight in Mr. Edwards's Collection. I have adopted the specific name which he has given to it. As to the genus it does not from its shape strictly deserve the name of *Bulimus*, and I have therefore referred it only provisionally to that genus; indeed, so close do some of the so-called *Cyclostomæ* approach other shells called *Bulimi* that it is difficult to draw a satisfactory line between them. The nearest resemblance to this shell known to me is *Bulimus turgidulus*, Desh., 'An. sans Vert. du Bas. de Par.,' t. xi, p. 533, pl. liv, figs. 25—27; but judging from the figure and description of that species, it is, I think, quite distinct.

Genus 11th.—*SUCCINEA*. *Draparnaud*, 1801.

For generic character see *antè*, p. 80.

No. 260. *SUCCINEA SPARNACENSIS?* *Deshayes*. Tab. XXXIV, fig. 10*.

SUCCINEA SPARNACENSIS, *Desh.* An. sans Vert. du Bas. de Par., t. ii, p. 795, pl. lii, figs. 30—32, 1858.

Spec. Char. *S. Testá elongato-ovatá, obliquá, tenui, lævi; spirá acutiusculá; anfractibus depressis; aperturá ovatá, obliquá, anticè subdilatatá; columellá tenui; labro acuto.*

Length, $\frac{7}{16}$ ths of an inch.

Locality. Headon Hill (*Edwards*).

A very perfect specimen of a species of *Succinea* is in Mr. Edwards's Cabinet, of which the figure as above referred to is a representation. It has somewhat the appearance of a recent specimen from its perfection, but seems to want the amber-coloured tinge of the common living shell. So little difference is shown among the so-called species of this genus that it becomes a matter of extreme difficulty to distinguish them; I give it, however, as a fossil from its being in Mr. Edwards's Collection and marked from Headon Hill, but I cannot warrant its genuineness. The specific name of *gracilis* is attached to Mr. Edwards's specimen, and I would have adopted it, but this name has been

used by the late Mr. Alder for a variety of *Succinea putris* (very well figured by Capt. Brown in his 'Brit. Conchology,' pl. xlii, figs. 34, 35), and I thought the double use of this name would cause confusion. Our present shell so much resembles a species figured and described by M. Deshayes that I have referred it as probably identical, though with doubt, as I am unable to compare it with a specimen of the French Eocene species and have to rely on the figure. In describing this fossil M. Deshayes observes that it is exceedingly difficult with his shell (of which I presume he must have had more than one specimen, as he speaks of it as being in his own cabinet and also that of M. Dutemple) to point out a difference. He says (p. 795), "Cette espèce a beaucoup de rapports avec le *Succinea putris*, qui habite en Europe; mais elle n'en a pas moins avec d'autres qui se plaisent dans les régions chaudes de l'Inde et de l'Amerique," and I can fully endorse this remark. In comparing the figure of our shell with specimens of the common living British species in my own cabinet (*S. putris*) there does appear to be a slight difference, the fossil having its volution a trifle less inflated or convex, or rather they seem to be more depressed. The French shell is from the "Lignites of Bernon near Epernay," a deposit which is considered to be equivalent to our Lower Eocene, whereas ours comes from the upper division of that formation. It is to be feared we attach more importance to trifling variation in our specific determination of these freshwater shells than we do to those which come from salt-water deposits.

Genus 31st.—BYTHINIA.¹ Gray, 1824 (Prideaux, MS.).

Generic Character. Shell conical, turbinated; volutions convex; aperture slightly angular behind; peristome simple, entire, continuous; operculum testaceous, irregularly concentric, with its nucleus nearly in the middle.

Animal oviparous, eyes sessile.

This genus has been separated from *Paludina* in consequence (as it is said) of its being oviparous, while *Paludina* is ovoviviparous; but this distinction is not well established, and if it were it would be unavailing to the palæontologist. It differs in having a calcareous operculum, while in *Paludina* this is corneous. It is also said that the eyes of *Bythinia* are somewhat differently placed.

¹ The name for this genus has been variously spelt:

Bithinia, J. E. Gray, G. P. Deshayes.

Bithynia, Watelet.

Bythinia, Jeffreys, Sandberger.

No. 261. BYTHINIA CONICA ? *Prévost*. Tab. XXXIV, fig. 8 a, b.

PALUDINA CONICA, *Prév.* Journ. de Phys., p. 11, 1821.

— — *Desh.* Coq. foss. des Env. de Par., t. xi, p. 129, pl. xvi, fig. 7, 1824.

— ? IMPURATA, *S. Wood*. Lond. Geol. Journ., p. 118, 1846.

BITHINIA CONICA, *Desh.* An. sans Vert. du Bas. de Par., t. ii, p. 494, 1858.

HYDROBIA (BITHYNIA) CONICA, *J. Lowry*. Chart Brit. Tert. Foss. pl. ii, 1866.

ASSIMINEA CONICA, *Sandb.* Land- und Süssw.-Conch., p. 212, t. xi, fig. 11, 1872.

Spec. Char. “*B. Testá ovato-conicá, lævigatissimá, acuminatá, anfractibus planulatis, suturá superficiali separatis; aperturá ovato-angulatá; marginibus acutis.*”—*Desh.*

Height, $\frac{5}{16}$ ths of an inch.

Locality, Britain: Hordle (*S. Wood*), Headon Hill (*Edwards*).

France: Vaugirard (*Deshayes*).

I have copied the specific diagnosis as given by Deshayes for *B. conica* which seems to correspond so precisely with that of our fossil that I think the two may fairly be referred to one and the same species. Many years ago I found a specimen of this genus at Hordle to which I gave the name of *Paludina? impurata* from its very close resemblance to the one so common in our own freshwaters, and so very abundant in the freshwater deposits of our Upper Tertiaries, at Grays and Clacton (*Paludina impura*, Brard, *Helix tentaculata*, Linné).

The figures given in my plate are somewhat enlarged. This species may probably be variable where a large number of individuals are found like these specimens of *B. tentaculata* so numerous at Grays and Clacton, where they show a considerable variation in their proportionate dimensions, some being much more elongated than others, a variation which produces one also in the tumidity of the volutions.

Dr. Sandberger has referred this to *Assiminea*, a genus proposed by Dr. Leach for a shell found in the Woolwich marshes and sent by him to the late Dr. Fleming with the name *Assiminea Grayana* “as the type of a new freshwater genus,” ‘Hist. Brit. An.,’ p. 275. This shell much resembles that of *Bythinia*, but it is described as having an operculum that is spiral, while that of *Bythinia* is increased by concentric layers; and although we have not the operculum of this shell to guide us, it seems so very closely to resemble our common shell *Bythinia tentaculata*, that I think it must belong to the same genus.

The operculum when it can be obtained is, I think, a good character to assist in establishing a genus, but the operculum of our species has not yet been found. In *Paludina* and *Bythinia* the operculum is increased by concentric layers, while in *Hydrobia*, *Nematura*, and *Assiminea* it is spiral. A small shell, *Nematura pupa*, Nyst, is very abundant in our Upper Eocene Beds at Headon Hill, but its operculum has not yet been found, as in all probability it was a corneous one. The late Mr. G. B. Sowerby figured and

described ('Mag. of Nat. Hist.' for 1837, p. 217) a recent species, *N. Delta*, in which the operculum is represented *in situ*, and this is spiral and horny. M. Bosquet has, however, figured a fossil found in the Limbourg Beds as *Nematura pupa* ('Reck. Paléont. Terr. Tert. du Limb.,' 1859, p. 7, pl. i, fig. 6), and at fig. 7 he represents what he thinks may be the operculum of this species, but which is quite different in form from the one figured as recent, being in shape like *Ancylus? latus* (F. Edwards, 'Eocene Moll.,' p. 110, pl. xiv, fig. 15), and of which the late Dr. S. P. Woodward, in his 'Manual of Mollusca,' p. 16, says, "This fossil appears to be a *Limax*."

The following Fluvatile shells from the Lower Tertiaries of England may, I think, be separated into genera or sectional divisions, as indicated by the operculum; and had I been able to continue this work, it was my intention to have done this.

1. PITHARELLA, *Edwards*, 1860.

"Shell subcylindrical; spire obtuse, more or less produced; aperture oval-oblong, rounded in front, narrowed behind; columella straight or very slightly twisted, arched anteriorly; outer lip simple, acute; inner lip thickened."

Operculum unknown.¹

Type. P. Rickmani, *Edwards*.²

2. PALUDINA, *Lamarck*, 1812.

"Operculum horny, irregularly concentric, having its nucleus on the inner side."

Type. *Helix vivipara*, *Linné*.

3. BYTHINIA, *J. E. Gray*, 1821.

"Operculum testaceous and solid, irregularly concentric, having its nucleus nearly in the middle."

Type. *Helix tentaculata*, *Linné*.

? 4. AMNICOLA, *Gould and Haldemann*, 1841.

"Shell ovate-conical, thin; spire acute, composed of a few rounded whorls; aperture small, oblique, and roundedly ovate; lips continuous, simple. Operculum horny, spiral, with few volutions."

Type. *Amnicola Parkinsoni*, *Sandberger*.

¹ In Mr. A. Bott's cabinet is a fossil which has the appearance of an operculum. This I intended to have had figured. It is of an elongately oval or lanceolate form, and apparently with concentric ridges, though these are not very distinct. I think possibly it may have belonged to the above genus.

² A shell resembling this generically is figured and described by Prof. Deshayes as *Ampullaria problematica* ('An. sans Vert. du. Bas. de Par.,' tom. xi, p. 521, pl. xxxvi, figs. 1, 2), and another, possibly the same species, is figured and described by Melleville in his 'Mém. sur les Sab. Tert. Infér.,' p. 72, pl. x, fig. 1, as *Buccinum arenarium*.

5. ASSIMINEA, *Leach*, 1816.

"Operculum horny; paucispiral nucleus on the inner side of the mouth."

Type. Assiminea Grayana, *Leach*.

6. HYDROBIA, *Hartmann*, 1821.

"Operculum horny and thin, marked with flexuous and rather strong lines of growth, and having a small lateral spire of three whorls."

Type. Turbo ulvæ, *Pennant*.

7. NEMATURA, *Benson*, 1836.

"Operculum spiral, horny, of few volutions, somewhat concave externally, rather larger than the aperture."

Type. Nematura Deltæ, *Benson*.

? 8. VALVATA, *Müller*, 1874.

"Operculum horny, circular, slightly compressed in the middle, forming a concentric spire of from 10 to 12 whorls, the outer edges of which are thickened and raised so as to project over and partly overlap the succeeding whorl."

Type. Nerita piscinalis, *Müller*.

Genus 13th.—PLANORBIS. *Geoffroy*, 1767.

For generic character see *antè*, p. 97.

No. 262. PLANORBIS LÆVIGATUS? *Deshayes*. Tab. XXXIV, fig. 1 *a—b*.

PLANORBIS LÆVIGATUS, *Desh.* Coq. foss. des Env. de Par., t. xi, p. 85, pl. x, figs. 1, 2, 1824.

— — *Id.* An. sans Vert. du Bas de Par., tom. ii, p. 746, 1858.

— — *Prestwich.* Geol. Journ., vol. x, p. 118, 1854.

— — *Whitaker.* Geol. Surv., vol. iv, p. 576, 1872.

Spec. Char. "*Pl. Testá discoideá, lævigatissimá, tenui, symmetricá, depressá, rotundatá, anfractibus quaternis, valdè apparentibus; utroque latere umbilico æquali.*"—*Desh.*

Diameter, $\frac{3}{16}$ ths of an inch.

Locality. Brit.: Dulwich (*Bott.*), Counter Hill (*Whitaker*), Peckham (*Meyer*).

France: Bernon, near Epernay (*Deshayes*).

Two or three specimens of this species have been found in our English beds, but all that I have seen are in the condition of casts; they, however, appear to correspond with

the figure and description given by M. Deshayes. The species, as he says, much resembles the young state of *Pl. rotundatus*, but the sutures are deeper, and it approaches nearer in form to *Pl. Sparnacensis*. This latter shell is, however, spirally striated, whereas our species is said to be perfectly smooth—a feature which our specimens, being casts, of course do not show; but *Sparnacensis* appears to have a larger number of volutions in the same space, and from what can be seen of the form of the volution in our specimen it appears to have had a semilunate aperture, the volutions on the under side being rather more convex than those on the upper, which is the flatter of the two.

The figure represents a specimen from Mr. Bott's cabinet, and is the most perfect one that I have seen.

Planorbis elegans, F. Edwards, 'Eocene Moll.,' p. 107, tab. xv, fig. 12 *a—b*, so far as figures and description go, appears to correspond with *Pl. Baudoni*, Desh., 'An. sans Vert. du Bas. de Par.,' t. xi, p. 750, pl. xlv, figs. 28—31.

Genus 12th.—LIMNÆA. *Lamarck.*

For generic description see *antè*, p. 81.

No. 263. LIMNÆA ELONGATA, *Marcel de Serres*. Tab. XXXIV, fig. 10.

LIMNEUS ELONGATUS, *Sandb.* Land- und Süssw.-Conch., p. 287, t. xvi, fig. 6, 1872.

— — *Marcel de Serres*. Ann. Sci. Nat., p. 179, pl. xii, fig. 7, 1844.

Spec. Char. “*Testá ovato-conicá, turritá, apice peracutá, anfractus septem paulo convexi, saturis tenuibus disjuncti, transversim subtiliter striati, ultimus inflator $\frac{2}{3}$ omnis altitudinis æquat; aperturá ovali, basi paulo dilatatá columellá tenui, paulo contortá.*”—*Sandberger.*

Height, $1\frac{1}{8}$ th of an inch; *width*, $\frac{1}{2}$ an inch.

Locality. Hordle (*S. Wood*).

Three individuals of this form are in my cabinet, having been found by myself at Hordle, and I have assigned them to the above species with some doubt.

The spire of this shell is small and tapering, with about eight volutions; these are slightly convex like those of *L. longiscata*, but there is no flatness or semisulcation on the left lip or columella; on the contrary, this is sharp and prominent. It seems also to differ from *L. fusiformis*, which has more flattened volutions, and a comparatively larger aperture. I had previously considered it as an aberrant form of *L. pyramidalis* with closer volutions. Figure 11 of the same Plate represents a specimen belonging to the recent British species, *L. stagnalis*, which I have introduced in order to show the varia-

tion to which some of the species of this genus have been subject, and the consequent uncertainty which attaches to their identification.

Sandberger has figured and described a British fossil under the above name *elongatus*, which, he says, was received from Mr. Edwards, but his figure is rather less elongated than are my specimens.

I have not seen any specimen of *Limnæa* from the Lower Eocene of England, neither have I seen any fossil from either our Upper or Lower Eocene beds that can be referred to the genus *Physa*, though several species of that genus have been figured by M. Deshayes from the Paris Basin.

FAM.—NERITIDÆ.

Genus 32nd.—NERITINA. *Lamarck, 1809.*

Generic Character. “*Testa tenuis, semiglobosa vel ovalis, subtus planulata, non umbilicata; aperturâ semi-rotundâ; labro columellari planulato; margine acutiusculo subrecto, plerumque denticulato, labro externo intus nec dentato nec crenulato; operculum testaceum semicirculare; internè appendice laterali instructum.*”

This has been separated from *Nerita*, and intended for those species which inhabit fresh water; but there is little or no difference in the form and general character of the shells of the two genera, and most of our present species inhabit waters that are neither salt or fresh, as it is to be presumed did their fossil congeners. They can only be distinguished under the above respective generic names by the palæontologist, according to the indication of habit which at their association with either known marine or estuarine species affords, although among living species there are two (*N. viridis* and *N. meleagris*) which, belonging to the section grouped as *Neritina*, nevertheless, are found in the sea.

This diagnosis of *Neritina*, as given by Lamarck (*tenuis*), is not restricted to the number of shells that have been figured and described under this generic name, several of them being as thick and ponderous as many of the species called *Nerita*. Some are not externally smooth, but are ornamented with ridges and carinæ; others have denticulations more or less upon the outer and inner lips, while the opercula of *Nerita* and *Neritina* are thick and possess the same characters alike. M. Deshayes, in the second edition of Lamarck's ‘Hist. Nat. An. sans Vert.,’ vol. viii, p. 565, has made some very just remarks upon the similarity of these genera; and in his last work, ‘Hist. des An. sans Vert. du Bas. de Par.,’ he has grouped all these hitherto called *Neritina* as simply a section of *Nerita*. As, however, I am describing land and fluviatile shells of the older Tertiaries, I have thought it best to retain the name of *Neritina* for those species which, if not restricted to a habitat in fresh water, are met with where the water

is not purely salt, and where also they are found in association with such truly freshwater genera as *Limnæa* and *Planorbis*. The most general distinction among existing species is that the *Neritinae* are generally smooth shells and free from spiral ridges, but this rule is not without exception, as some few species possess spiral striæ or depressed ridges.

The form of the species of this genus varies, but in a slight degree, and the larger number of the fossils have the external markings well preserved; but these markings are so variable on specimens even of the same species, not unfrequently resembling the markings usual on other species, that they do not afford much assistance in their specific separation. The dark lines seem to be as well preserved on some of our fossils as are the red spots on other shells of older date; so that the preservation of colour on several of our Tertiary species is not reserved to red alone.

No. 264. *NERITINA GLOBULUS*, *Férussac*. Tab. XXXIV, fig. 18 *a, b*.

- NERITINA GLOBULUS*, *Férussac*. Hist. des Moll. Pl. de Neritines Foss., fig. 14, 1851.
 — — *Desh.* Coq. foss. des Env. de Par., p. 151, pl. xvii, figs. 19 20, 1824.
 — — *Desh.* An. sans Vert. du Bas. de Par., t. xi, p. 22, 1858.
 — — *Whitaker*. Mem. Geol. Surv., vol. iv, p. 576, 1872.
 — *UNIPPLICATA*; *J. Sow.* Min. Conch., t. cccclxxxv, figs. 9, 10, 1823.
 — *CALLIFERA*? *G. B. Sow.* Genera of shells; *Neritina*, fig. 7, 1855.

Spec. Char. *N. Testá orato-globulosá, spirá brevissimá, planiusculá, anfractibus tribus, ultimo maximo oblongo lævigato, supra convexo, subtus concavo; aperturá magná latè semilunari; arcú columellari planá, lævigatá, margine acuto, in medio paulo excavato, posterius unidentato.*

Diameter, $\frac{1}{4}$ of an inch.

Localities. Brit.: Charlton (*S. Wood*), Plumstead, Peckham, New Cross (*Meyer*).

France: Epernay, Mont Bernon (*Deshayes*).

This is by no means rare, and it appears to be restricted to the Lower Eocene Formation in England, as it is also said by M. Deshayes to be in France.

The apex of this shell is very slightly elevated, and generally more or less eroded; the volutions are indicated by a narrow line of suture; the columella is broad, flat, and moderately sharp when the specimen is in good condition, and furnished with one prominent tooth at the upper part, but on the lower the denticles are obsolete or very minute, and there are no spiral striæ on the exterior. This is a plain-looking shell; and sometimes portions of the epidermis have been preserved on the specimens.

No. 265. *NERITINA CONSOBRINA*, *Férussac*. Tab. XXXIV, fig. 13 *a*, *b*.

- NERITINA CONSOBRINA*, *Férussac*. Hist. des Moll. Pl. de Neritines Foss., fig. 12, 1820.
 — — *Desh.* Coq. foss. des Env. de Par., tom. ii, p. 153, tab. xix, figs. 5, 6, 1824.
 — — *Id.* (2nd edit. *Lam.*). Hist. An. sans Vert., tom. viii, p. 595, 1838.
 — — *Id.* An. sans Vert. du Bas. de Par., t. cxi, p. 22, 1858.
 — — *Morris.* Catal. Brit. Foss., 2nd edit., p. 264, 1854.
 — — *Whitaker.* Mem. Geol. Surv., vol. iv, p. 579, 1872.
 — *ORNATA?* *Melleville.* Sables. Tert. Inf., p. 50, pl. vi, figs. 9, 10, 1843.

Spec. Char. *N. Testá ovato-globosá, spirá brevi, obtusissimá; anfractibus tribus, ultimo maximo convexo, lavigato, aperturá semilunari, arcá columellari latissimá, in medio tenui dentatá, posterius uniplicatá, labro dextro plano.*

Diameter, $\frac{1}{4}$ of an inch.

Localities. Britain: Charlton (*S. Wood*), Peckham (*Meyer*).

France: Lignites, Epernay (*Deshayes*).

Specimens of this species do not appear to be very rare from the Woolwich beds, and Mr. C. J. Meyer sent me for examination a good series of them.

So far as I am able to determine this species, its greatest difference from *globulus* consists in a more elevated spire and in a broad depression on the upper part of the volution a little below the suture. It is not so globular. The specimens from near Epernay are said to have retained much of their original colour; "sur le dernier tour on voit trois zones transverses inégales, blanchâtres sur un fond d'un brun noir quelquefois roussâtre;" *Desh.*, Lamarck, 2nd edit. The specimens which I have seen, however, are of one uniform colour.

Neritina pisiformis, *Férus.*, is given by Mr. De la Condamine in 'Quart. Journ. Geol. Soc.,' vol. vi, p. 446, and by Mr. Prestwich, 'Quart. Journ. Geol. Soc.,' vol. x, pp. 103 and 118, as from the Lower Eocene Beds at Woolwich and Charlton, and it is on this authority inserted by Mr. Whitaker, as he informs me, in his lists in the 'Geol. Survey Memoir,' pp. 576 and 579; but I have seen nothing among the specimens of my collecting friends which could by that name be specifically distinguished from *N. globulus* or from *N. consobrina*. Probably the shell thus referred to may have been a variety of one or the other of these, unless the shell now called *N. jaspidea* should be the one intended.

No. 266. *NERITINA VICINA?* *Melleville*. Tab. XXXIV, fig. 15 *a*, *b*.

- NERITINA VICINA*, *Mellev.* Mém. Sables Tert. Inf. du Bas. de Par., p. 51, pl. vi, figs. 11, 12, 1843.
 — — *Whitaker.* Mem. Geol. Surv., vol. iv, p. 579, 1872.

Spec. Char. *N. Testá minutá, ovato-oblongá, transversá; spirá brevi depressá; supra convexá, subtus concavá; anfractibus tribus, primis minimis, ultimo maximo, lævigato, nitido; aperturá semilunari; areá columellari latá, planá aut subconcavá.*

Diameter, $\frac{1}{8}$ th of an inch.

Localities. Britain: Charlton (*S. Wood*).

France: Env. de Chalons (*Deshayes*).

A small shell in my cabinet, figured as above, seems to correspond with the figure and description given by M. Melleville in some respects, but not quite so in others; and I have in consequence put a mark of doubt to the name. It differs from the small and young specimens of *globulus (uniplicata, Sow.)*, a shell abundant in the Woolwich beds, in being more expanded or extended outwardly; and there is a difference in the left lip or columella which is thicker and not so flat, and is destitute of a tooth on the upper part. It is less elevated in the spire than *consobrina* and more expanded than *jaspidea*. Unfortunately I have only met with the one specimen of this shell, which is figured.

No. 267. NERITINA JASPIDEA?, *Deshayes*. Tab. XXXIV, fig. 17 a—c.

NERITINA JASPIDEA, *Desh.* An. sans Vert. du Bas. de Par., t. iii, p. 20, pl. lxx, figs. 14—16, 1858.

Spec. Char. "*N. Testá ovato-oblongá, supra-convexá, subtus concavá; spirá brevi, obtusissimá, submarginatá; anfractibus tribus, primis minimis, ultimo maximo, lævigato, nitido; lineis fuscis irregularibus, undulatis, plus minusve numerosis ornato, aliquantisper zonolis angustiusculis interruptis; aperturá obliquá, minimá, semilunari; areá columellari latá, planá vel concavá, declivi; margine columellari acuto, concavo, posterius unidentato.*"

—*Deshayes*.

Diameter, $\frac{1}{7}$ th of an inch.

Localities. Britain: Dulwich (*Meyer*).

France: Brimont, Chalons-sur-Vesus, Gueux (*Deshayes*).

Some specimens beautifully marked have been obligingly sent to me for examination by Mr. C. Meyer, two of which with very varied markings I have had figured as above and referred them with doubt to *jaspidea*. Our specimens do not conform strictly to the one given and described under this name by M. Deshayes, but they differ greatly from the little shell which I have called *N. vicina*, which is much more expanded in its volutions, has a more extended aperture, and appears to be destitute of exterior ornamentation, though, as before observed, this latter is not a reliable character. The specimens figured much resemble a recent Jamaica form, *N. pupa*. The prominent tooth, shown by M. Deshayes, is indistinct in the British fossil.

No. 268. *NERITINA CONCAVA*, *J. Sowerby*. Tab. XXXIV, fig. 14 *a—c*.

NERITINA CONCAVA, *J. Sow.* Min. Conch., tab. cccclxxxv, figs. 1—8, 1823.

— — *Desh.* (2nd edit. *Lamk.*) An. s. Vert., t. viii, p. 597, 1838.

— — *Morris.* Catal. Brit. Foss., 2nd edit., p. 264, 1854.

— — *J. Lowry.* Chart Brit. Tert. Foss., pl. iii, 1866.

— — *Lyell.* Students' Elemts. of Geol., p. 231, 1871.

— — *Sandberg.* Land- und Süßw.-Conch., p. 267, tab. xv, fig. 13, 1872.

NERITA — *Nyst.* Coq. foss. de Belg., p. 436, pl. xxxvii, fig. 30, 1843.

Spec. Char. *N. Testá ovato-globosá, lævigatá, apice obtuso; lineolis fuscis parallelis vel reticulatis tenuissimis ornatá; anfractibus suprá concavis; aperturá semicirculari; columellá arcuatá, in medio tenuiter denticulatá.*

Diameter, $\frac{3}{8}$ ths of an inch.

Localities. Hempstead (*Morris*), Headon Hill, Muddiford (*S. Wood*).

Belgium: Kleyn-Spauwen (*Nyst*).

This species is abundant at Headon Hill, and the operculum also is sometimes found, a figure of which I have given. This operculum is flat on the exterior, and has not the curvilinear depression possessed by that of *N. Forbesii*. The projecting prominent teeth on the inside appear also to be different from that on the operculum of *Forbesii*, the two bifurcations of the denticle being unequal in size, and expanding more widely. The outer lip of our shell is plain and sharp, the inner moderately extended; and the columella is sharp-edged and slightly concave, and has upon its centre about half a dozen fine denticles. These shells are variously ornamented on the exterior, generally having fine cancellated openings, produced by lines of oblique brownish colouring matter, crossed by similar oblique lines which together form small, lozenge-shaped, white spaces, but the lines are sometimes confluent.

This species is not mentioned as a fossil of the Paris Basin, but the shell from Kleyn Spauwen, as given by M. Nyst, appears to be identical with it, and that author has given as a synonym of it *N. picta*, of Dubois, from Volhynia, though with a doubt. In the description of Dubois' species, however, the words "*columella unidentata*" occur, a character which our species does not possess.

Mr. Whitaker, in his 'Memoir,' at p. 579, has introduced *conca* as from the Woolwich beds at Charlton, but this I have not been able to verify, and I conclude that it was inserted on the authority of the reference by J. Sowerby in 'Min. Conch.' tab. 385, of that shell to Charlton, an erroneous reference, as pointed out by Mr. Prestwich in 'Quart. Journ. Geol. Soc.,' vol. x, p. 121. Mr. Sowerby also in the same table represents a specimen said to be from Highgate, but it does not look like our own shell, as the volutions (which in that figure are sinistral) do not exhibit that concave depression on their upper part which is peculiar to this species, and from which its name was, I presume, given. Some specimens have a white spiral band, like that upon *N. ornata*.

No. 269. *NERITINA TRISTIS*, *Forbes*. Tab. XXXIV, fig. 12 *a, b*.

NERITINA TRISTIS, *Forbes*. Mem. Geol. Surv. Isle of Wight, p. 46, 1856.

— — *J. W. Lowry*. Chart Brit. Foss., pl. ii, 1866.

Spec. Char. *N. Testá fuscá, ovato-oblongá, tenui, spirá brevi, obtusá, anfractibus tribus, ultimo magno, aperturá magná semilunari, columellá planá margine simplici, labro acuto, edentulo.*

Diameter, $\frac{5}{16}$ ths of an inch.

Locality. Hempstead (*Forbes*).

A few specimens were many years ago given to me by the late Edward Forbes with the above specific name attached. These appear to differ from *N. concava* in having a rather less elevated spire and a slight depression round the upper part of the volution, as in *concava*; but I can discover no angularity in the volutions. It is of a uniform sombre or brownish colour, from which I presume it received its name. This has not been figured in the 'Geol. Survey Memoir,' but it is very well represented by Mr. Lowry in his 'Illustrations of British Fossils' above referred to. Forbes described it ('Memoir Geol. Survey,' p. 46) as "a small globose shell, with volutions rather angulated; aperture semilunate, inner lip obscurely denticulated, surface smooth without ornamentation."

No. 270. *NERITINA APERTA*, *J. Sowerby*. Tab. XXXIV, fig. 20 *a, b*.

NERITA APERTA, *J. Sow.* Min. Conch., t. ccccxiv, figs. 2, 3, 4, 1823.

— — *Morris*. Catal. Brit. Foss., 2nd edit., p. 264, 1854.

— — *J. Lowry*. Chart Brit. Tert. Foss., pl. iii, 1866:

NERITINA (MITRULA) APERTA, *Sandb.* Land- und Süssw.-Conch., p. 269, t. xv, figs. 15, 15 *a*, 1872.

Spec. Char. *N. Testá subglobosá, apice depresso, vix conspicuo; anfractibus 2—3; lineis tenuibus ornatá; aperturá semilunari; margine dextro, acuto; columellá planá, margine acuto, in medio minutè denticulatá, posteriore unidentatá.*

Height, $\frac{1}{4}$ of an inch; *diameter*, $\frac{5}{16}$ ths of an inch.

Localities. Colwell Bay (*J. Sowerby*), Headon Hill, Milford (*S. Wood*).

The shell figured by Sowerby as above referred to is a good representation of a small specimen of this species, which is not rare in the Upper Eocene of Hampshire and the Isle of Wight. I have not, however, seen any so small as those represented in figures 3 and 4 of tab. 424 of 'Min. Conch.,' which, no doubt, were immature specimens. The ornamentation is variable, as pointed out by Mr. Sowerby, and the shells have more or

less of the original colour remaining upon them; but those I have from Milford, which appear to be of the same species, though rather larger, are destitute of colour or markings of any kind. The upper part of the outer lip is generally, though not always, slightly elevated above the vertex, and somewhat thickened within, at some distance from the edge. The inner lip is thick and flattened, with a sharp edge to the columella, which has a few denticles in the centre and a distinct tooth at the upper part.

This species seems to partake of the characters by which the genus *Nerita* is distinguished as well as of those of the genus *Neritina*, in which I have placed it.

No. 271. *NERITINA FORBESII*, *S. Wood*. Tab. XXXIV, fig. 16 *a—c*.

Spec. Char. *N. Testá ovato-oblongá, lævigatá, tenuissime lineolatá vel ornatá; spirá depressá; anfractibus rapidè crescentibus, aperturá semilunari expansá; areá columellari latá, planá, in medio tenuissimè denticulatá; labro acuto simplici.*

Diameter, $\frac{2}{3}$ ths of an inch.

Locality. Headon Hill (*S. Wood*).

This is equally abundant with *N. aperta*, and I have separated it in consequence of its difference in form. Our present shell is narrower; that is to say, it has a more extended outer lip, the aperture being wider or more expanded from the inner lip to the outer than in the preceding species. The apex is also much depressed, and the upper part of the shell is nearly flat, with spire indicated by a narrow depressed suture. The coloured markings are various.

I have obtained several specimens of this species with its operculum in position, and this adjunct I have had figured. The inner side of the operculum is furnished with a prominent projection at the lower part, which is bifid or forked, expanding at an angle of about 45°. The outer side of this operculum shows a curvilinear depression with a corresponding elevation on the inner surface. *N. Forbesii* much resembles *N. fluvialis*, but that shell has a more elevated spire. It does not differ greatly from *N. transversa*, Ziegler, figured by Rossinasser, 'Icon.,' pl. vii, fig. 121, but I have not specimens of that species with which to compare it.

No. 272. *NERITINA ZONULA*, *S. Wood*. Tab. XXXIV, fig. 19.

Spec. Char. *N. Testá rotundato-ovatá, lævigatá; vertice depresso; anfractibus convexiusculis, zonulatis aut parum angulatis, supernè concavis; lineolis fuscis parallelis*

vel reticulatis tenuissimis ornatá; aperturá semilunari; columellá arcuatá, in medio denticulatá.

Diameter, $\frac{5}{16}$ ths of an inch.

Locality. Headon Hill (*S. Wood*).

This is a fossil of which I have myself found several specimens at the above locality. It resembles *N. aperta* in outward form, its most material difference consisting in its having six or seven very distinct ridges or carinulæ not quite equidistant, and somewhat rounded, but these the artist has unfortunately not sufficiently shown in the figure. No one, however, on comparing specimens with those of *aperta*, would fail to perceive these carinulæ.

No. 273. *NERITINA PLANULATA*, *F. E. Edwards*, MS. Tab. XXXIV, fig. 21 *a, b*.

NERITINA PLANULATA, *J. Lowry*. Chart Brit. Tert. Foss., pl. iii, 1866.

— — *Sandberger*. Land- und Süssw.-Conch., p. 263, t. xv, fig. 14, 1872.

Spec. Char. “*Testá globosá, apice obtuso, paulo eroso. Anfractus tres infrá suturas tenuissimas subimpressi, ceterum convexi, nitidi, flavidi, guttulis albis æqualiter conspersis aut seriatim depositis variegati; ultimus ceteris omnibus quadrato altior. Aperturá paulo obliquá semilunari, margine dextro et basali tenui, acuto, pariete et columellá callo nitido, leviter concavo, intus mediá parte plicá supremá maximá et duodecim minoribus obtusis munito oblectis. Operculum semilunare, infernè apophysis duabus arcuatis discrepantibus armatum.*”—*Sandberger*.

Height, $\frac{5}{16}$ ths of an inch.

Locality. Headon Hill (*Edwards*).

A very determinable figure is given of a shell under the above name by Mr. Lowry, who tells me it is a MS. name given by Mr. Edwards. This has been figured and described also by Sandberger from a specimen sent to him by Mr. Edwards. Our shell is prettily ornamented with diagonal and dark wavy lines. I have not the species.

Genus 33rd.—*NERITA*. *Adanson*.

For generic characters see *antè*, p. 342.

No. 274. *NERITA TRICARINATA*, *Lamarck*. Tab. XXXIV, fig. 22 *a, b*.

NERITA TRICARINATA, *Lamk*. Ann. du Mus., tom. viii, pl. lxii, fig. 4 *a, b*, 1806.

— — *Desh.* Coq. foss. des Env. de Par., t. ii, p. 160, 1824.

NERITA TRICARINATA, *Morris*. Catal. Brit. Foss., 2nd edit., p. 264, 1854.

— — *J. Lowry*. Chart Brit. Tert. Foss., pl. iii, 1866.

Spec. Char. *N. Testá ovatá, supra convexá, subtus convexiusculá; anfractibus tribus, ultimo magno, spiraliter tricarinato; spirá retusá; aperturá semicirculari; areá columellari planá, margine minutè denticulato, labro acuto.*

Diameter, $\frac{5}{16}$ ths of an inch.

Localities. Bracklesham (*Edwards*).

France: Rethuil, Cuise-la-Motte, Houdan (*Deshayes*).

The figure I have given is from a specimen in Mr. Edwards' cabinet. The shell has a fine denticulation on the sharp edge of the columella, but appears to be destitute of any prominent tooth on that edge, so far as I have been able to detect, in which respect it seems to agree with *Deshayes*' figure. The inside of the outer lip, however, appears to be free from those denticulations which usually ornament those species which are grouped under the generic name *Nerita*. This species is especially distinguished by being ornamented with three prominent spiral ridges, between which the surface is covered with regular and somewhat fine striæ. This species is said by M. *Deshayes* to be common in some localities of the Paris Basin, especially in the sands of Cuise-la-Motte. He also observes that several varieties of it occur in the Calcaire grossier. I am not aware of its having occurred in England in any other bed than the Bracklesham. M. *Deshayes* thus describes the operculum of this species ('An. sans Vert. du Bas. de Par.,' t. iii, p. 17):—"Il est lisse en dessus, obliquement partagé par une étroite depression, qui part du sommet. Il est fort remarquable en ce qu'il porte deux apophyses; l'une *subapiciale*, *bifide*, c'est celle qui existe invariablement dans toutes les espèces; l'autre *mediane* consiste en une proéminence aplatie et pointue, qui glisse en dessous du bord columellaire."

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. The Synonyms are printed in *Italics*.

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VOLUTA *spinosa*, var. *platyspina*, Sowerby ; see *Voluta pugil*.

.. *subambigua*, d'Orbigny ; see *Voluta elevata*.

.. *suspensa*, Solander

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.. *tricornata*, Sowerby

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.. *uniplicata*, Sowerby

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.. *Wetherellii*, Sowerby

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TAB. I.

Fig.

1. *Belosepia Sepioidea*, *p.* 29.
 - 1*a*—*c.* Var. *B. longirostris.*
 - a.* Dorsal aspect.
 - b.* Side view.
 - c.* Ventral aspect.
 - 1*d*—*f.* Var. *B. longispina.*
 - d.* Dorsal aspect.
 - e, e'.* Side views.
 - f.* Ventral aspect.
 - 1*g*—*i.* Var. *B. Blainvillii.*
 - g.* Side view.
 - h.* Do. of a cast of the Belosepion (*B. Sepioidea*).
 - i.* Ventral aspect.
2. *Belosepia brevispina*, *p.* 32.
 - a.* Dorsal aspect.
 - b.* Side view.
 - c.* Ventral aspect.
3. *Belosepia Cuvieri*, *p.* 31.
 - a, d.* Ventral aspect.
 - b.* Dorsal aspect.
 - c.* Side view.
4. Dorsal aspect of the Belosepion (*B. Sepioidea*).
5. Longitudinal section of ditto.
6. Enlarged view of the terminal cavity and rostrum in the same section.
7. Enlarged view of an obliquely transverse section of the terminal cavity.
8. Dorsal aspect of the sepion (*Sepia officinalis*).
9. Longitudinal section of ditto.
10. Enlarged view of section of the rostrum of ditto.



TAB. II.

1*a—g*. *Beloptera Belemnitoidea*, *p.* 36.

- a.* Ventral aspect.
- b.* Dorsal do.
- c.* Side view.
- d.* Longitudinal section.
- e.* Magnified view of do.
- f.* Ventral aspect of variety.
- g.* Dorsal aspect of do.

2*a—e*. *Beloptera Levesquei*, *p.* 37.

- a.* Ventral aspect
 - b.* Side view
 - c.* Dorsal aspect
- } of a young specimen.
- d.* Side view of an adult specimen.
 - e.* Ventral aspect of ditto.

3*a—e*. *Belemnosis plicata*, *p.* 40.

- a.* Dorsal aspect, nat. size.
- b.* Side view (enlarged) of the umbonal pore.
- c.* Ventral aspect enlarged.
- d.* Side view, nat. size.
- e.* Ventral aspect, ditto.



TAB. III.

Fig.

1*a*—*c*. *Nautilus centralis*, *p.* 45.

a. Back view.

b. Side view.

c. Do., young shell.

2*a*—*b*. *Nautilus urbanus*, *p.* 46.

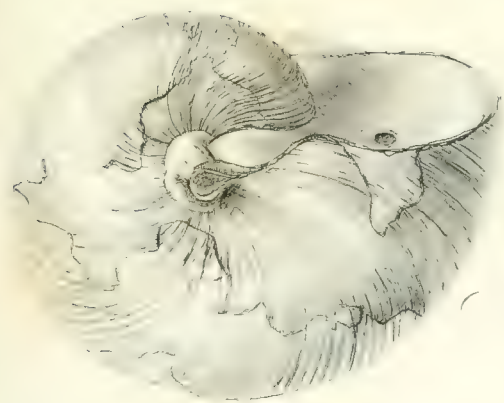
a. Side view, young shell.

b. Do., adult do.

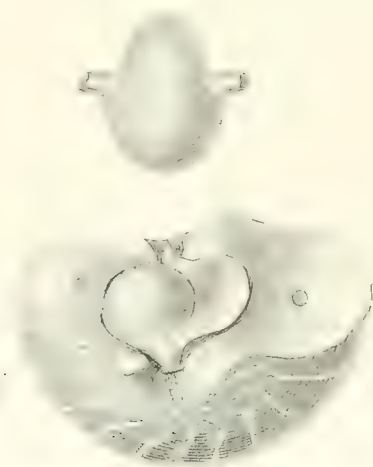




Nautilus regularis, p. 46

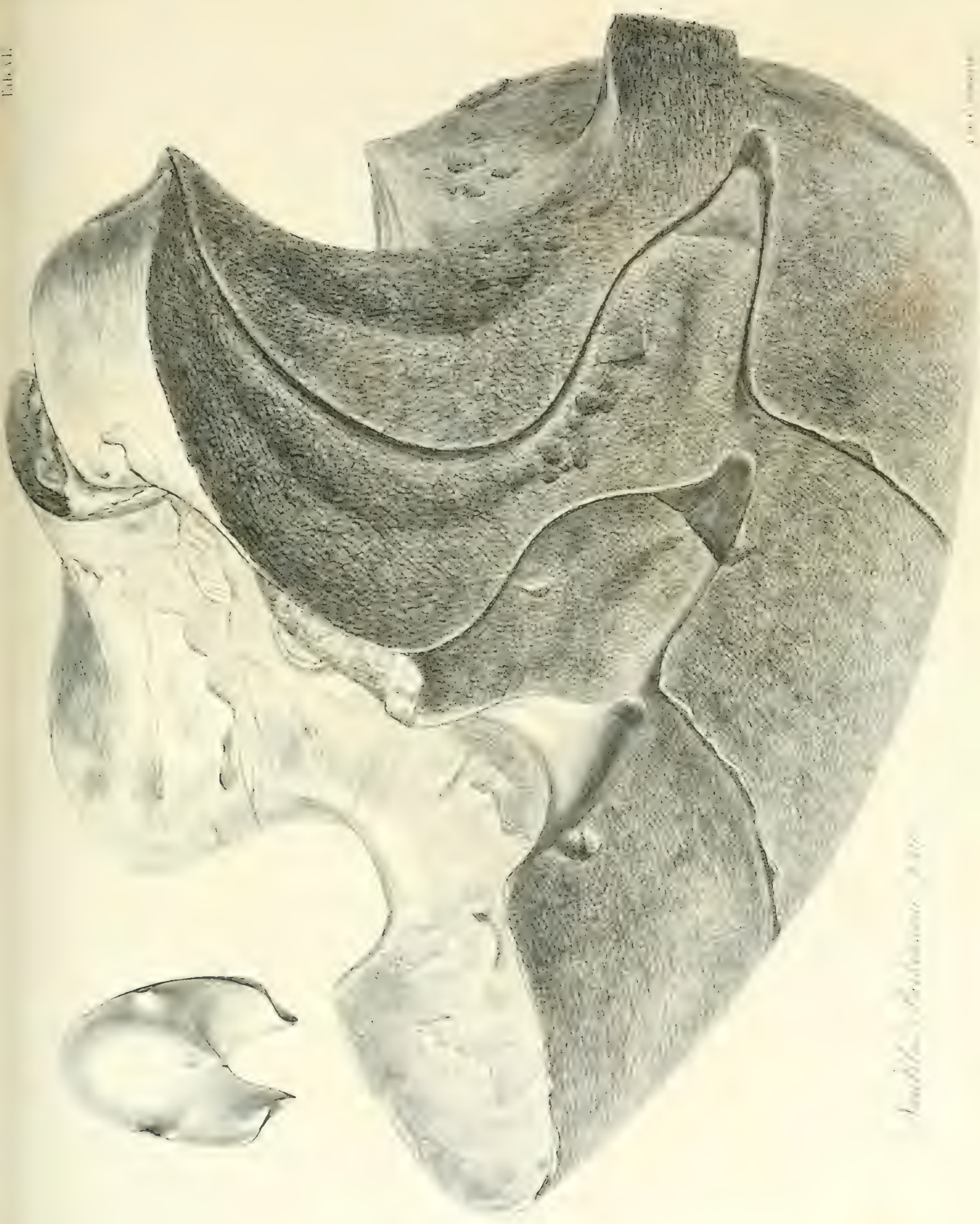


Nauticus imperialis L.





Acadellus tawaka sp. n.



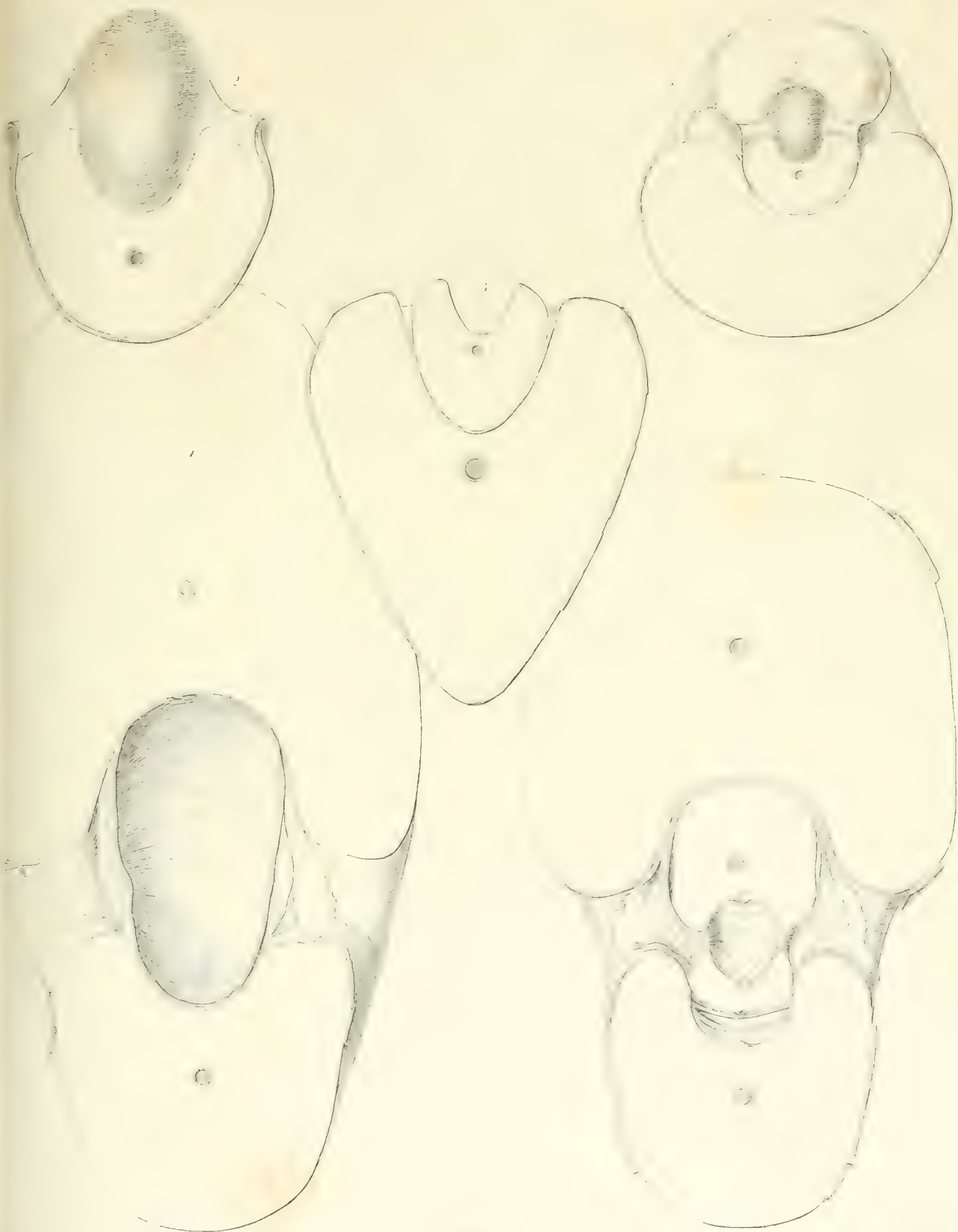
Protopithecus sp.

TAB. VIII.

Fig.

1. Transverse section showing the form of the septum in *Nautilus imperialis*, *p.* 47.

2	Do.	do.	<i>N. centralis</i> , <i>p.</i> 45.
3	Do.	do.	<i>N. Sowerbyi</i> , <i>p.</i> 48.
4.	Do.	do.	<i>N. urbanus</i> , <i>p.</i> 46.
5	Do.	do.	<i>N. regalis</i> , <i>p.</i> 46.



TAB. IX.

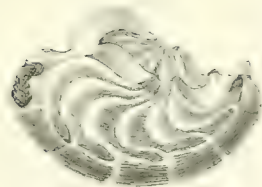
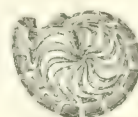
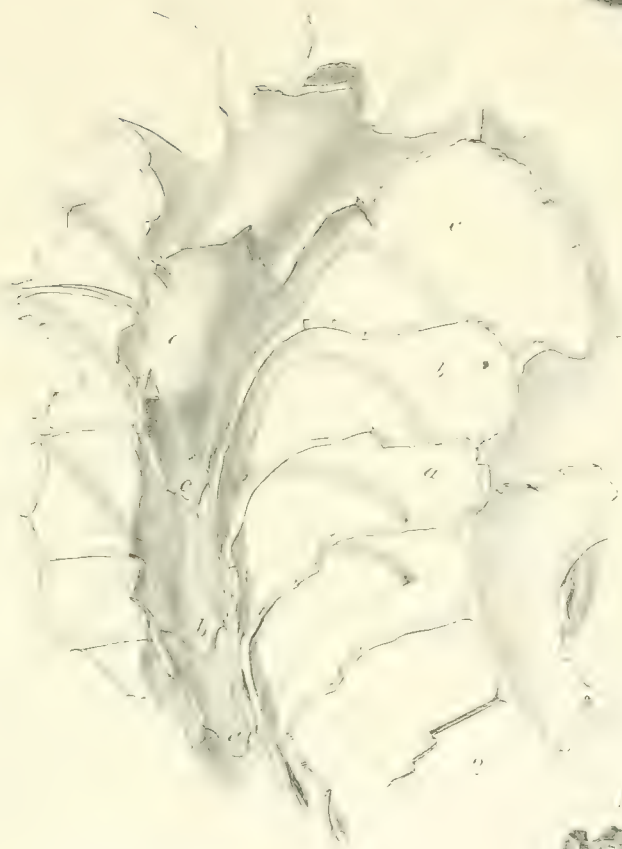
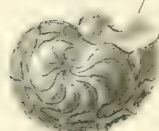
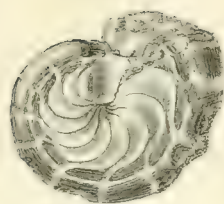
Fig.

1*a*—*h*. *Aturia zic-zac* (English specimens), *p.* 52.

- | | |
|-----------|---|
| <i>a.</i> | Side view of the typical form, from Highgate. |
| <i>b.</i> | Front view do. do. |
| <i>c.</i> | Side view do. from Sheppy. |
| <i>d.</i> | Front view do. do. |
| <i>e.</i> | Side view do. from Bracklesham Bay. |
| <i>f.</i> | Front view do. do. |
| <i>g.</i> | Side view of the compressed variety (β), from Chalk Farm. |
| <i>h.</i> | Front view do. do. |

2 and 3. *Aturia zic-zac* (Dax specimens).

2. Oblique view, showing the construction of the siphuncle.
3. Front view, showing the form of the septum.



TAB X.

Fig.

1. *Cyclotus cinctus*. No. 67, *p.* 117.

- a.* Back view of specimen with the shell preserved.
- b.* Front view of a cast.
- c.* Back view of ditto.

2. *Helix globosa*. No. 16, *p.* 63.

- a.* Front view of a cast of a shell in an intermediate stage of growth.
- b.* Front view of a cast of a young shell.
- c.* Back view of an adult specimen with the shell partly preserved.
- d.* Front view of ditto.

3. *Helix tropifera*. No. 18, *p.* 64.

- a.* Front view of a cast.
- b.* Upper surface of ditto.
- c.* Under surface of ditto.

4. *Melampus tridentatus*. No. 65, *p.* 113.

- a.* Front view.
- b.* Back view

5. *Helix D'Urbani*. No. 15, *p.* 62.

- a.* Front view, nat. size.
- b.* Ditto, magnified.
- c.* Under surface, magnified.
- d.* Upper surface „

6. *Helix omphalus*. No. 19, *p.* 65.

- a.* Front view, natural size.
- b.* Ditto, magnified.
- c.* Upper surface, ditto.
- d.* Under surface, ditto.
- e.* Portion of a whorl, magnified.

Fig.

7. *Helix labyrinthica*. No. 20, *p.* 67.

- a.* Back view, natural size.
- b.* Under surface, magnified.
- c.* Back view, ditto.
- d.* Front view, ditto.
- e.* Portion of the whorl magnified.

8. *Helix Vectiensis*. No. 14, *p.* 62.

- a.* Back view, natural size.
- b.* Under surface of a cast, magnified.
- c.* Front view, magnified.
- d.* Back view of a cast, ditto.
- e.* Portion of the whorl, magnified.

9. *Pedipes glaber*. No. 66, *p.* 115.

- a.* Back view, nat. size.
- b.* Ditto, magnified
- c.* Front view, ditto.

10. *Helix occlusa*. No. 17, *p.* 64.

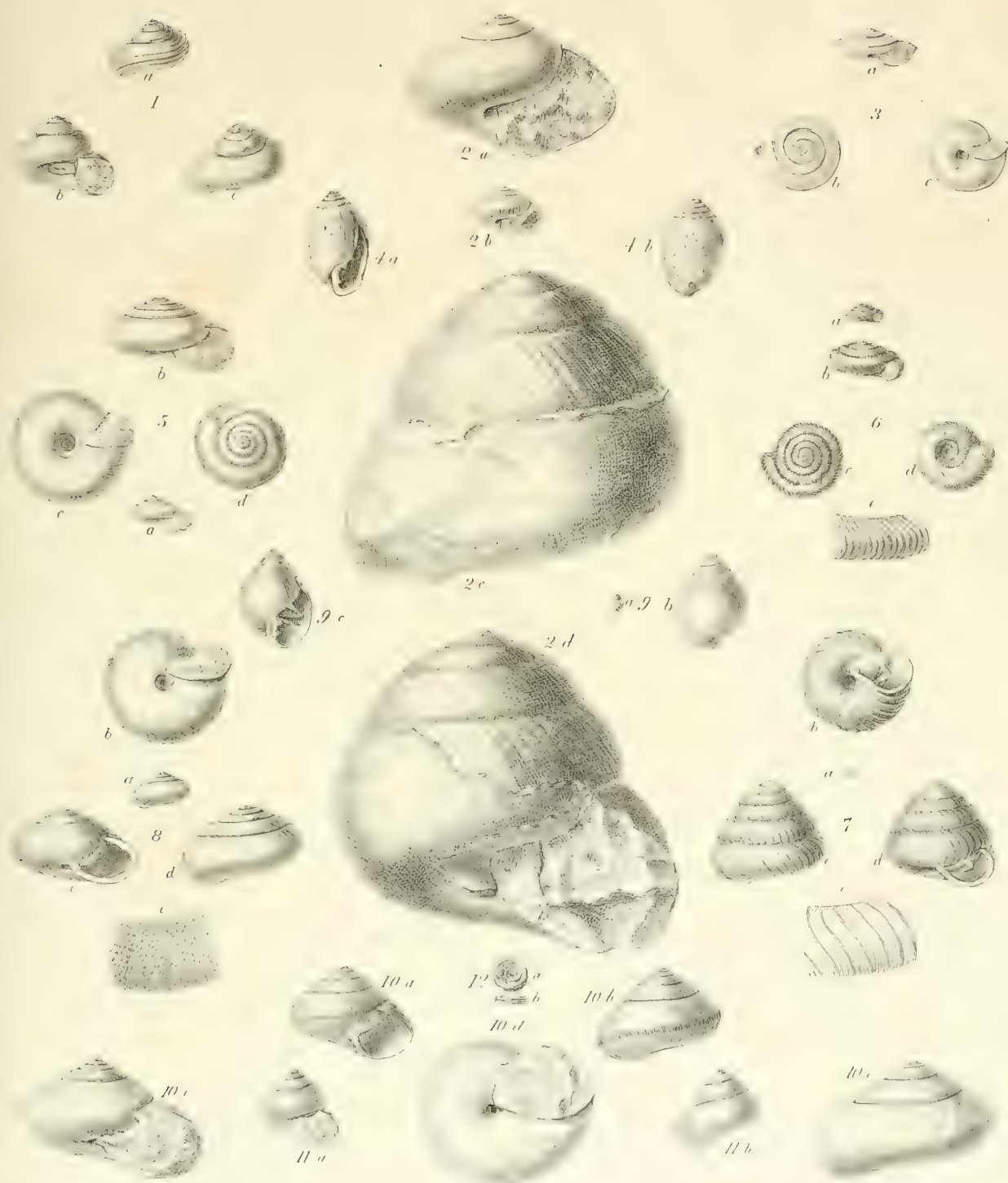
- a.* Front view of a specimen with the shell preserved.
- b.* Back view of ditto.
- c.* Front view of a cast.
- d.* Under surface of ditto.
- e.* Back view of ditto.

11. *Cyclotus nudus*. No. 68, *p.* 117.

- a.* Front view.
- b.* Back view.

12. Operculum of *Cyclotus*.

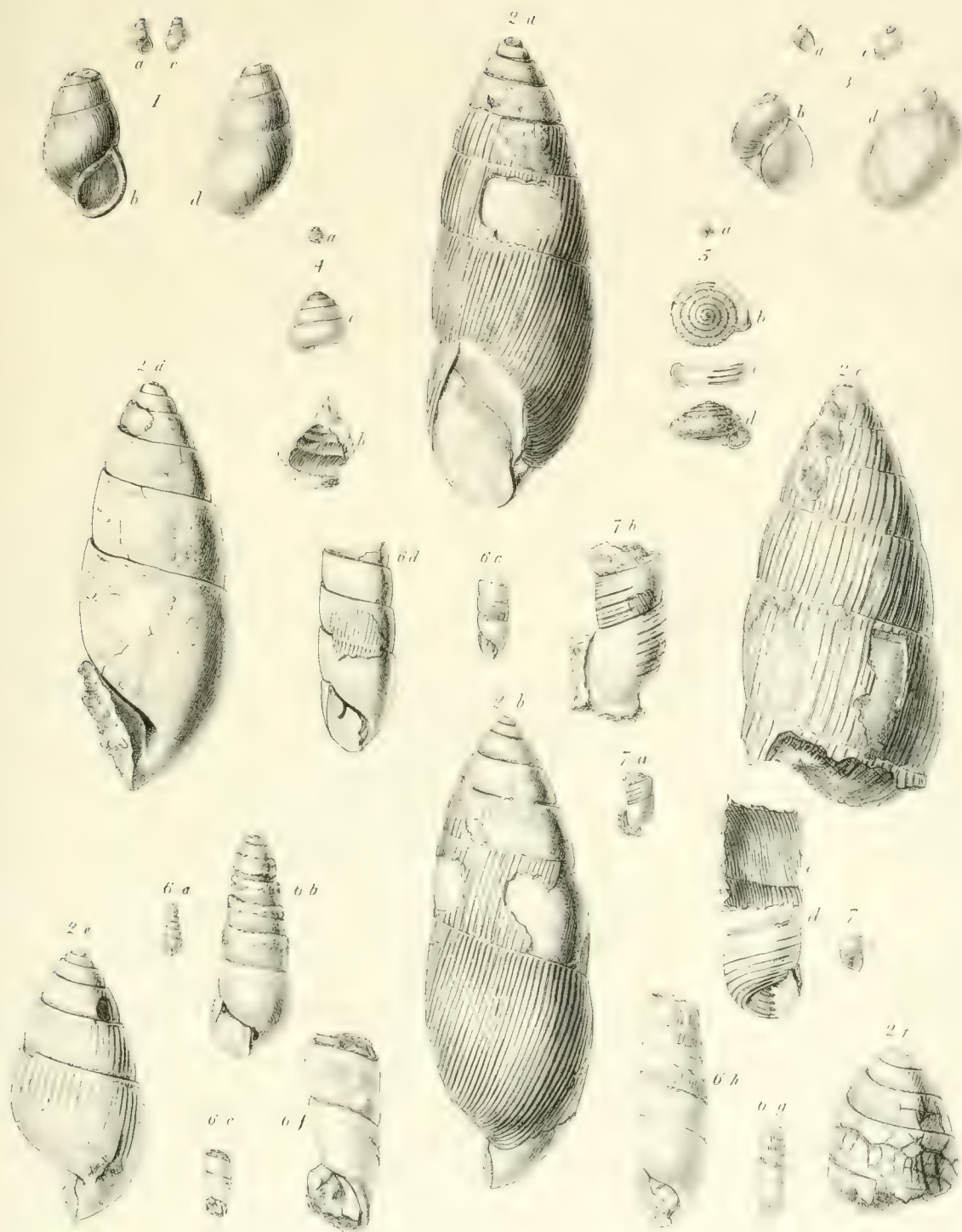
- a.* View of the outer disc.
- b.* Side view.



TAB. XI.

Fig.

1. *Bulimus politus*. No. 24, *p.* 73.
 - a.* Front view, natural size.
 - b.* Ditto, magnified.
 - c.* Back view, natural size.
 - d.* Ditto, magnified.
2. *Bulimus ellipticus*. No. 23, *p.* 72.
 - a.* Front view
 - b.* Side view.
 - c.* Fragment of a large specimen in the Brit. Mus.
 - d.* Side view of a cast.
 - e.* Side view of a cast, young.
 - f.* Fragment from Primrose Hill. (*B. tenuistriatus*, G. Sow.)
3. *Succinea imperspicua*. No. 29, *p.* 81.
 - a.* Front view, natural size.
 - b.* Ditto, magnified.
 - c.* Back view, natural size.
 - d.* Ditto, magnified.
4. *Helix sub-labyrinthica*. No. 21, *p.* 69.
 - a.* Front view of a cast, natural size.
 - b.* Impression of the whorl, magnified.
 - c.* Back view, magnified.
5. *Helix Headonensis*. No. 22, *p.* 70.
 - a.* Upper surface of a cast. Natural size.
 - b.* Ditto, ditto, magnified.
 - c.* Portion of the whorl of ditto, magnified.
 - d.* Front view of ditto, magnified.
6. *Clausilia striatula*. No. 28, *p.* 79.
 - a.* Front view of a cast of a young shell, nat. size.
 - b.* Ditto ditto, magnified.
 - c.* Front view of cast with parts of the shell preserved, nat. size.
 - d.* Ditto, ditto, magnified.
 - e* and *g.* Views of casts of adult shells, showing the aperture, nat. size.
 - f* and *h.* Ditto ditto, magnified.
7. *Pupa perdendata*. No. 26, *p.* 77.
 - a.* Back view of a cast (shell partly preserved), natural size.
 - b.* Ditto ditto, magnified.
 - c.* Front view of ditto, natural size.
 - d.* Ditto ditto, magnified.
 - e.* Impression of the whorls in the matrix, magnified.



TAB. XII.

Fig.

1. *Achatina costellata*. No. 25, *p.* 75.

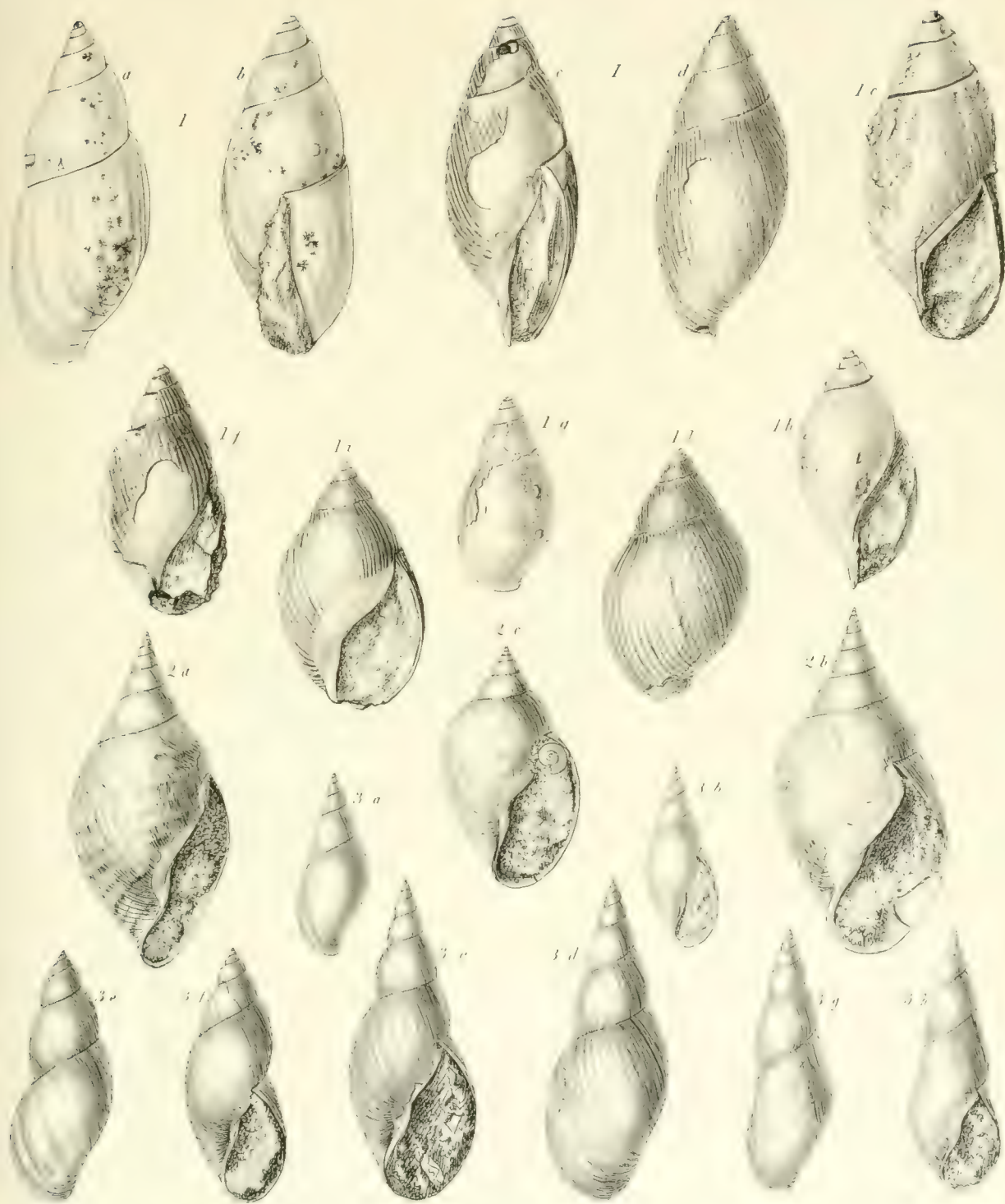
- a.* Back view of a cast.
- b.* Side view of ditto.
- c.* Front view of a specimen with the shell partly preserved.
- d.* Back view of ditto.
- e.* Front view of a cast.
- f.* Ditto of ditto, shell partly preserved. Young shell.
- g.* Back view of a cast of a young shell.
- h.* Front view of ditto.
- i.* Back view, var. *abbreviata*.
- k.* Front view, ditto.

2. *Limnæa caudata*. No. 30, *p.* 83.

- a.* Side view.
- b.* Front view.
- c.* Ditto, var. *abbreviata*.

3. *Limnæa longiscata*. No. 32, *p.* 85.

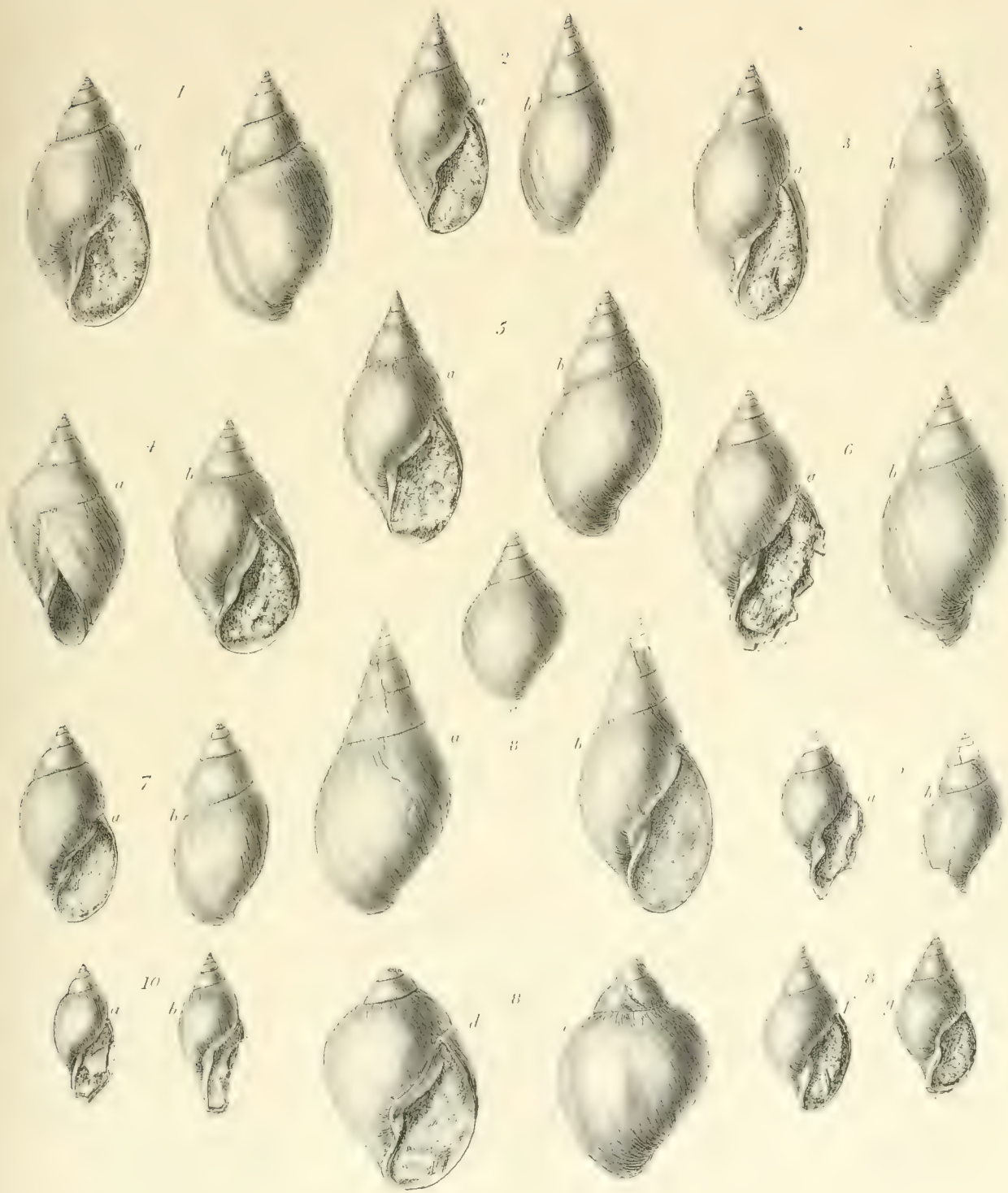
- a.* Back view, intermediate state of growth.
- b.* Front view, ditto.
- c.* Front view, adult shell.
- d.* Back view, ditto.
- e* and *g.* Back views, var. *distorta*.
- f* and *h.* Front views, ditto.



TAB. XIII.

Fig.

1. *Limnæa subquadrata*. No. 41, *p.* 92.
 - a.* Front view.
 - b.* Back view.
- 2 and 3. *Limnæa pyramidalis*. No. 31, *p.* 84.
 - a, a.* Front views.
 - b, b.* Back views.
4. *Limnæa sublata*. No. 35, *p.* 88.
 - a.* Side view.
 - b.* Front view.
5. *Limnæa mixta*. No. 36, *p.* 88.
 - a.* Front view.
 - b.* Back view.
6. *Limnæa tumida*. No. 39, *p.* 91.
 - a.* Front view.
 - b.* Back view.
7. *Limnæa convexa*. No. 42, *p.* 92.
 - a.* Front view.
 - b.* Back view.
8. *Limnæa fusiformis*. No. 38, *p.* 90.
 - a.* Back view of specimen from Headon Hill.
 - b.* Front view, ditto.
 - c.* Back view of ditto. Var. *deformis*, intermediate size.
 - d.* Front view of ditto ditto adult shell.
 - e.* Back view of ditto ditto ditto
 - f, g.* Front views of shells from Sconce. Intermediate stage of growth.
9. *Limnæa columellaris*. No. 40, *p.* 91.
 - a.* Front view.
 - b.* Back view.
10. *Limnæa costellata*. No. 43, *p.* 93.
 - a* and *b.* Front views.



TAB. XIV.

Fig.

1. *Bulimus heterostomus*. No. 70, *p.* 119.
 - a.* Front view of a cast, nat. size.
 - b.* Ditto, magnified.
 - c.* Side view of ditto of the aperture, magnified.
 - d.* Impression of the whorls in the matrix, magnified.
2. *Velletia elegans*. No. 64, *p.* 112.
 - a.* View from above, nat. size.
 - b.* Ditto, magnified.
 - c.* Side view, ditto.
 - d.* View of the aperture, ditto.
3. *Pupa oryza*. No. 27, *p.* 78.
 - a.* Side view, nat. size.
 - b.* Ditto, magnified.
4. *Limnæa sulcata*. No. 33, *p.* 87.
 - a.* Front view.
 - b.* Back view.
5. *Limnæa cincta*. No. 45, *p.* 94.
 - a.* Front view.
 - b.* Back view.
6. *Limnæa angusta*. No. 46, *p.* 95.
 - a.* Front view.
 - b.* Back view.
7. *Limnæa recta*, No. 49, *p.* 96.
 - a.* Front view.
 - b.* Back view.
8. *Limnæa gibbosula*. No. 34, *p.* 87.
 - a* and *b.* Front views.
 - c.* Back view.

Fig.

9. *Limnæa minima*. No. 48, *p.* 96.
 - a.* Back view, nat. size.
 - b.* Front view, magnified.
 - c.* Back view, ditto.

10. *Limnæa fabulum*. No. 44, *p.* 93.
 - a.* Front view.
 - b.* Back view.

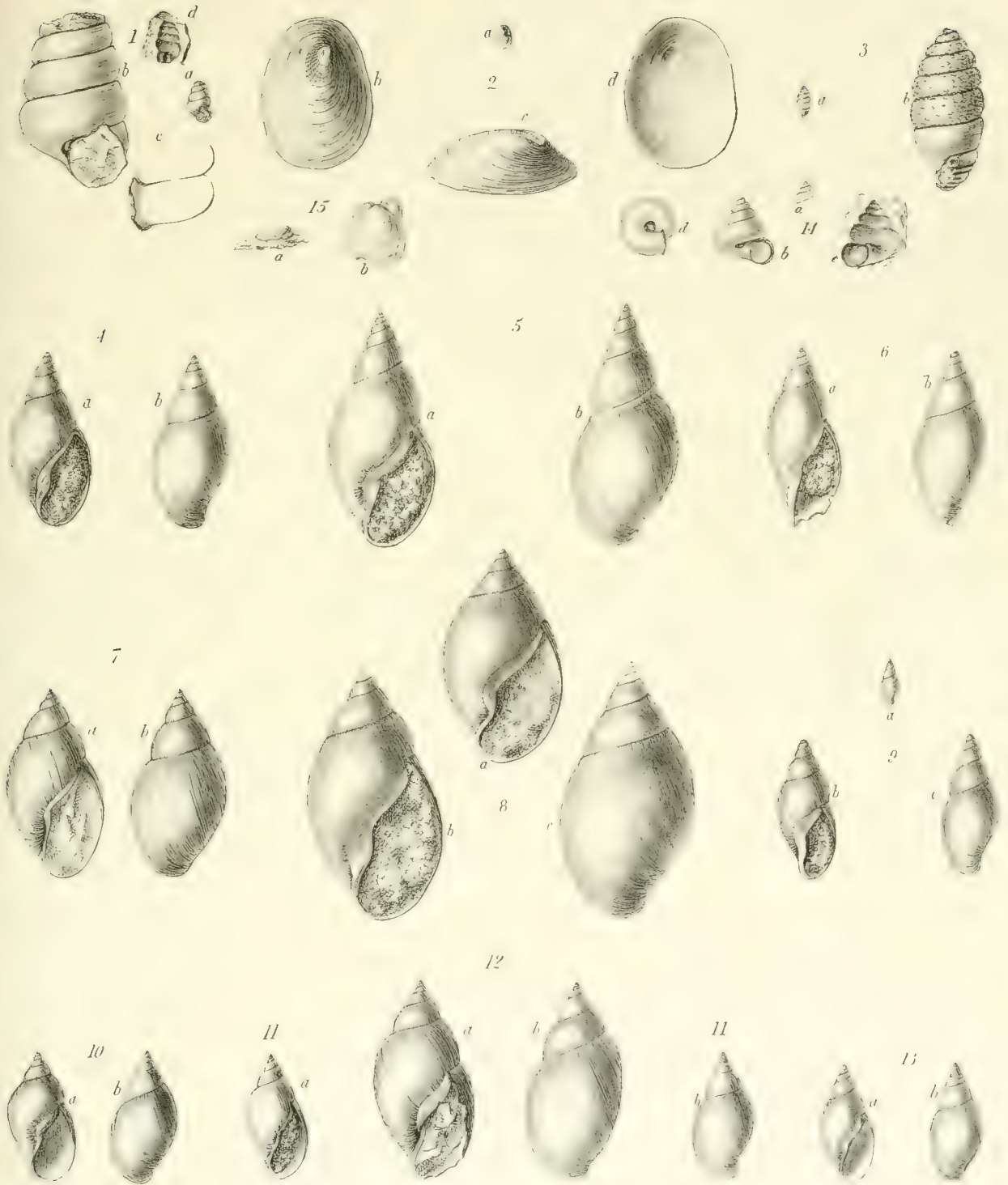
11. *Limnæa tenuis*. No. 50, *p.* 97.
 - a.* Front view.
 - b.* Back view.

12. *Limnæa ovum?* No. 37, *p.* 89.
 - a.* Front view.
 - b.* Back view.

13. *Limnæa arenularia*. No. 47, *p.* 95.
 - a.* Front view.
 - b.* Back view.

14. *Craspedopoma Elizabethæ*. No. 69, *p.* 118.
 - a.* Front view, nat size.
 - b.* Ditto, magnified.
 - c.* Impression in the matrix, magnified.
 - d.* View of the base ditto.

15. *Ancylus?* *latus*. No. 63, *p.* 110.
 - a.* Side view, nat. size.
 - b.* View from above, magnified.

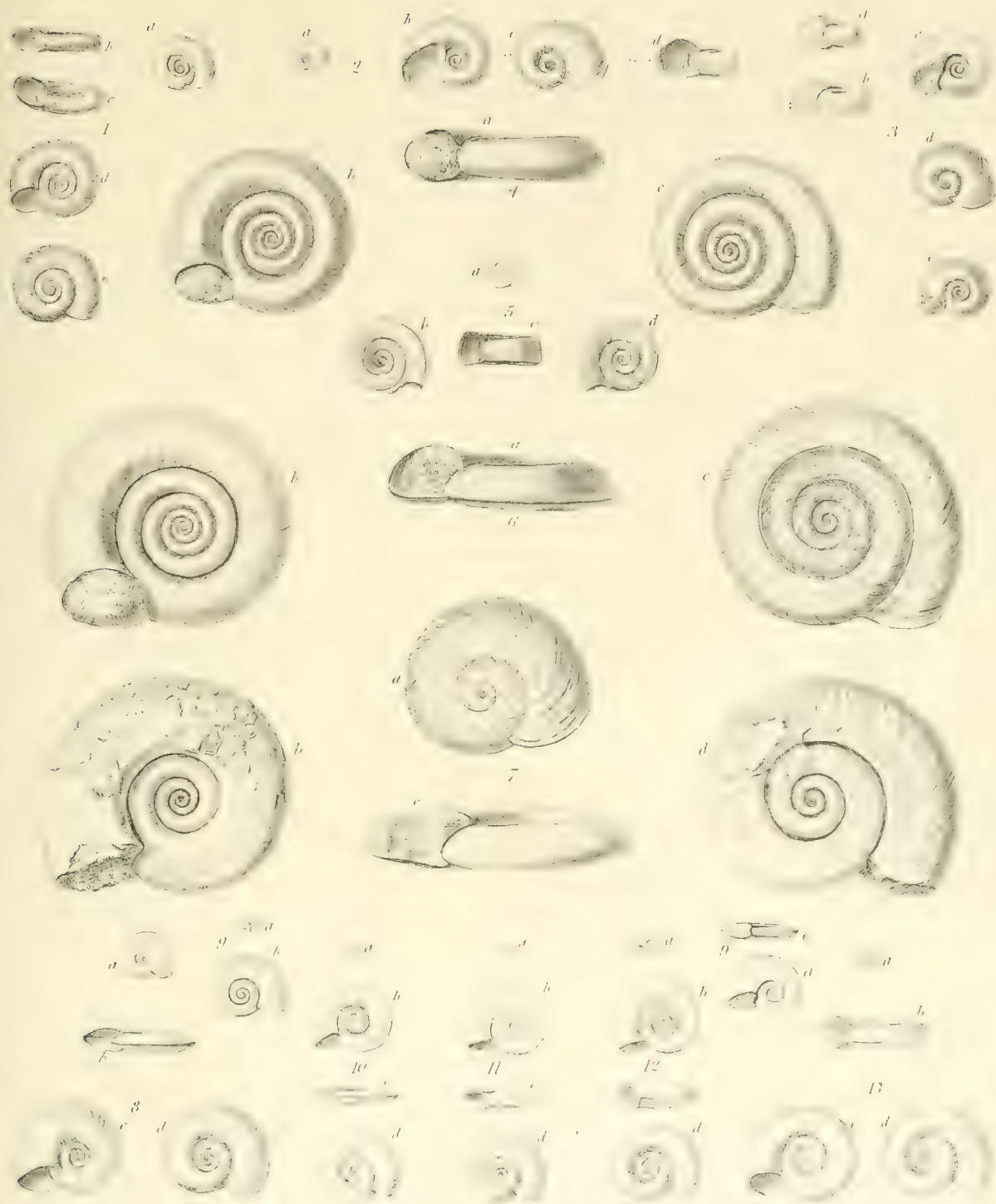


TAB. XV.

Fig.

1. *Planorbis obtusus*. No. 53, *p.* 102.
 - a.* View of the upper disc (distorted specimen).
 - b.* Side view.
 - c.* Ditto (distorted specimen).
 - d.* View of the under disc.
 - e.* View of the upper disc.
2. *Planorbis platystoma*. No. 56, *p.* 103.
 - a.* View of the upper disc, nat. size.
 - b.* View of the under disc, magnified.
 - c.* View of the upper disc ditto.
 - d.* View of the aperture ditto.
3. *Planorbis oligyratus*. No. 55, *p.* 103.
 - a, b.* Views of the aperture.
 - c.* View of the under disc.
 - d.* View of the upper disc.
 - e.* View of the under disc of a cast.
4. *Planorbis rotundatus*. No. 52, *p.* 100.
 - a.* Side view showing the aperture.
 - b.* View of the under disc.
 - c.* View of the upper disc.
5. *Planorbis euomphalus*. No. 51, *p.* 99.
 - a.* View of the upper disc. Young shell.
 - b.* Ditto ditto ditto.
 - c.* Side view, showing the aperture in ditto.
 - d.* View of the under disc of ditto.
6. *Planorbis euomphalus*. No. 51, *p.* 99.
 - a.* Side view of adult shell.
 - b.* View of the under disc of ditto.
 - c.* View of the upper disc of ditto.
7. *Planorbis discus*. No. 54, *p.* 102.
 - a.* View of the upper disc, with the shell preserved (intermediate stage of growth).
 - b.* View of the under disc of a cast.
 - c.* Side view of a cast.
 - d.* View of the upper disc of a cast.

8. *Planorbis lens*. No. 57, *p.* 104.
- a.* View of the upper disc, nat. size.
 - b.* Side view, magnified.
 - c.* View of the under disc, ditto.
 - d.* View of the upper disc, ditto.
9. *Planorbis Sowerbyi*. No. 62, *p.* 108.
- a.* View of the upper disc of a cast, nat. size.
 - b.* Ditto ditto magnified.
 - c.* Side view of ditto, showing the aperture, ditto.
 - d.* View of the under disc of ditto, magnified.
10. *Planorbis tropis*. No. 58, *p.* 106.
- a.* View of the under disc, nat. size.
 - b.* Ditto ditto magnified.
 - c.* Side view of ditto ditto.
 - d.* View of the upper disc ditto.
11. *Planorbis hemistoma*. No. 59, *p.* 106.
- a.* View of the under disc, nat. size.
 - b.* Ditto ditto magnified.
 - c.* Side view of ditto ditto.
 - d.* View of the upper disc ditto.
12. *Planorbis elegans*. No. 60, *p.* 107.
- a.* View of the under disc, nat. size.
 - b.* Ditto ditto magnified.
 - c.* Side view of ditto ditto.
 - d.* View of the upper disc ditto.
13. *Planorbis biangulatus*. No. 61, *p.* 108.
- a.* View of the upper disc, nat. size.
 - b.* Side view of ditto magnified.
 - c.* View of the under disc ditto.
 - d.* View of the upper disc ditto.



TAB. XVI.

Fig.

1. *Cypræa oviformis*. No. 71*, *p.* 128.

- a.* Back view, adult shell from Primrose Hill.
- b.* Front view of the same.
- c.* Front view, adult shell from Highgate.
- d.* Front view, adult shell (globose var.) from Whetstone.
- e.* Back view, young shell (first stage) from Barnett.
- f.* Front view of the same.
- g.* Side view, (shell in second stage), from Potter's Bar.
- h.* Side view, adult shell, showing the inner whorls.
- i.* Original specimen from the well on Hampstead Heath, described as *Ovulum retusum*.

2. *Cypræa tuberculosa* (Var. *Coombii*). No. 75, *p.* 131.

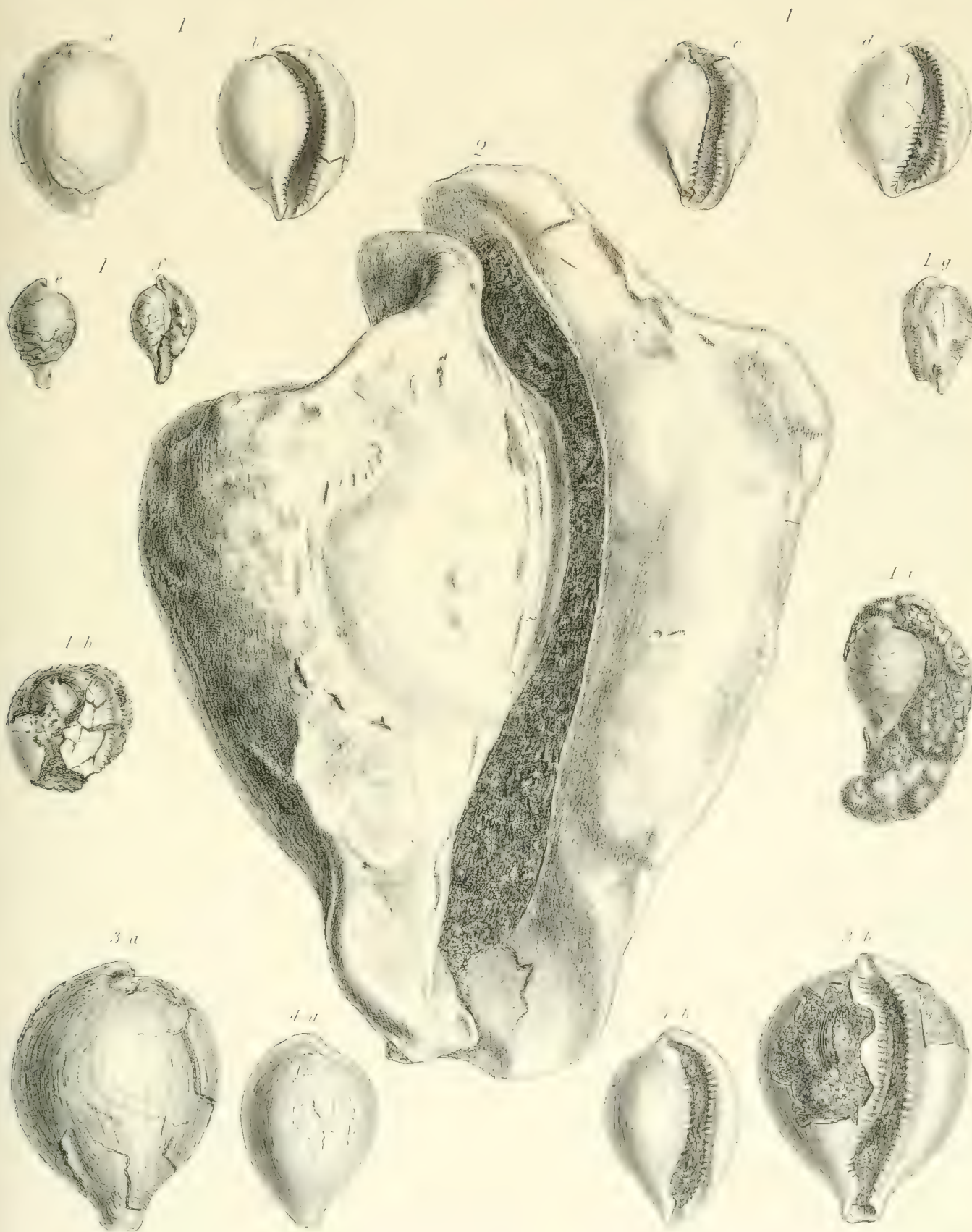
Front view.

3. *Cypræa globularis*. No. 73, *p.* 130.

- a.* Back view.
- b.* Front view.

4. *Cypræa inflata*. No. 71, *p.* 126.

- a.* Back view.
- b.* Front view.

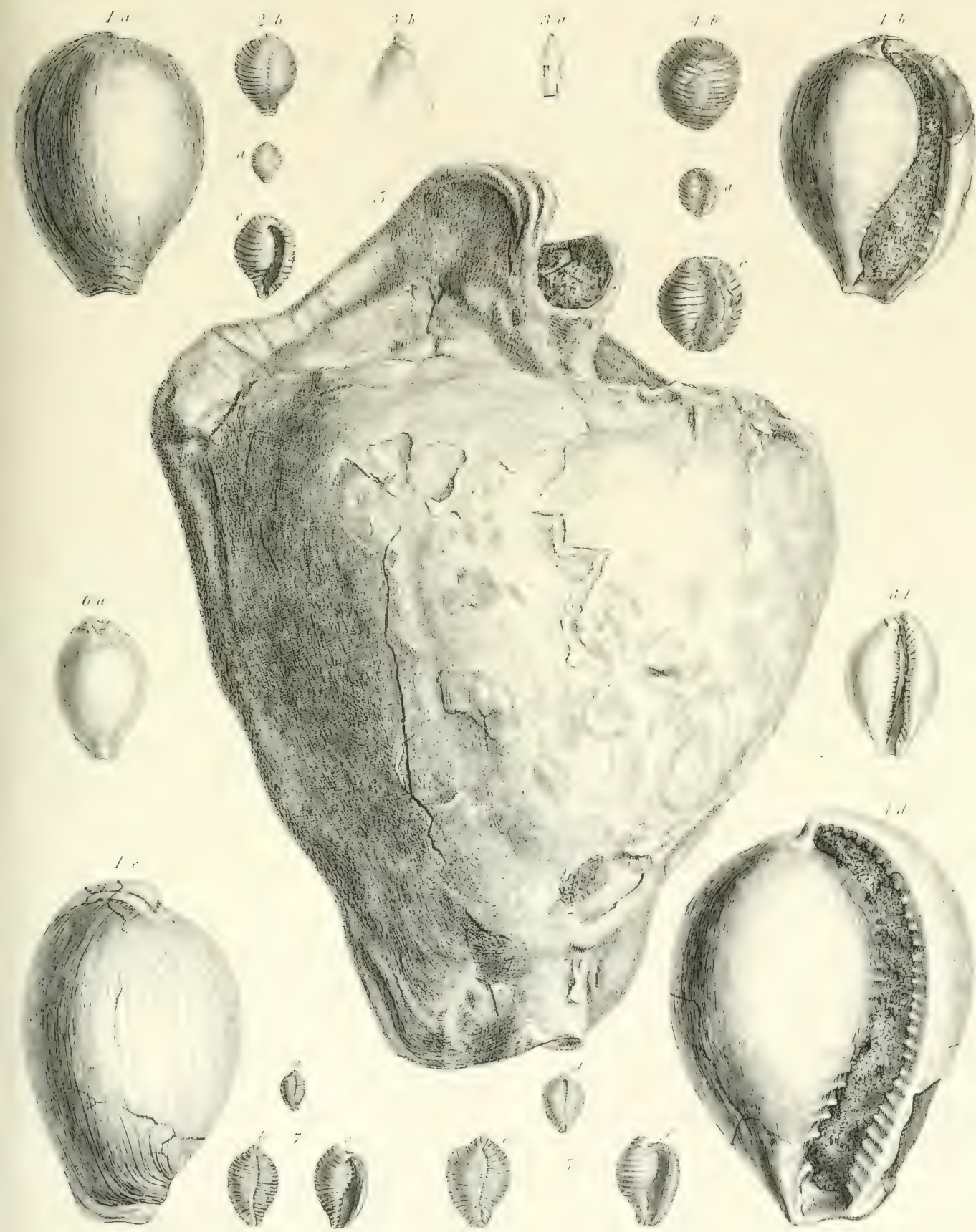


TAB. XVII.

Fig.

1. *Cypræa Bowerbankii*. No. 72, *p.* 129.
 - a.* Back view, shell from Highgate.
 - b.* Front view of the same.
 - c.* Back view, shell from Bracklesham Bay.
 - d.* Front view, ditto.
2. *Cypræa Prestwichii*. No. 78, *p.* 134.
 - a.* Back view, natural size.
 - b.* Back view of the same, magnified.
 - c.* Front view of the same, ditto.
3. *Ovula?* *antiqua*. No. 79, *p.* 136.
 - a.* Back view, natural size.
 - b.* Back view of posterior extremity, magnified.
4. *Cypræa Wetherellii*. No. 77, *p.* 133.
 - a.* Front view, natural size.
 - b.* Back view of the same, magnified.
 - c.* Front view of the same, ditto.
5. *Cypræa tuberculosa*, (Var. *Coombii*). No. 75, *p.* 131.

Back view.
6. *Cypræa Bartonensis*. No. 74, *p.* 130.
 - a.* Back view.
 - b.* Front view.
7. *Cypræa platystoma*. No. 76, *p.* 132.
 - a.* Back view of young shell, natural size.
 - b.* Back view of the same, magnified.
 - c.* Front view of the same, ditto.
 - d.* Back view of adult shell, natural size.
 - e.* Back view of the same, magnified.
 - f.* Front view of the same, ditto.

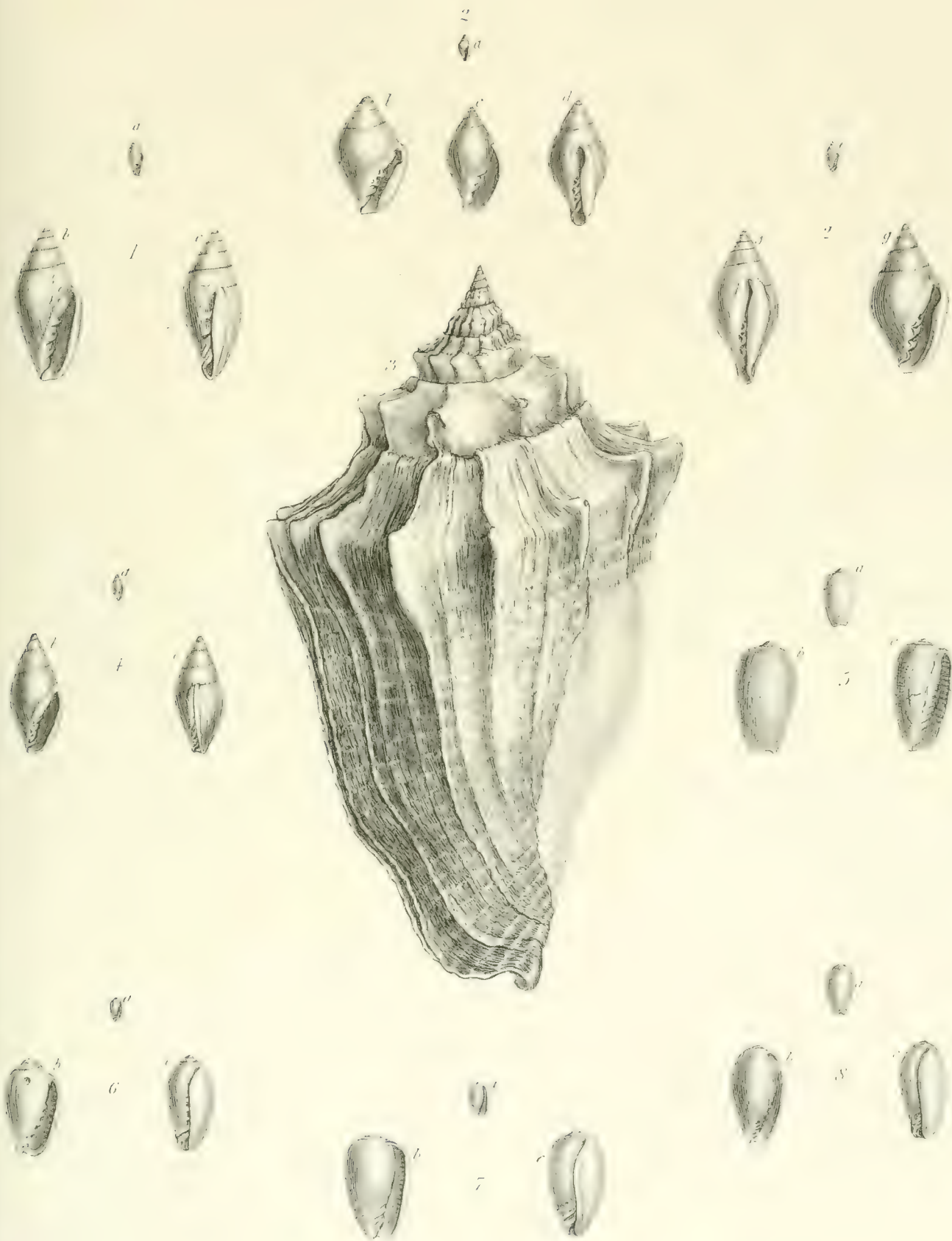


TAB. XVIII.

Fig.

1. *Marginella eburnea*. No. 80, *p.* 137.
 - a.* Front view, natural size.
 - b.* Front view, magnified.
 - c.* Side view, ditto.
 2. *Marginella bifido-plicata*. No. 81, *p.* 139.
 - a.* Front view of adult shell from Barton, natural size.
 - b.* Front view of the same, magnified.
 - c.* Front view of young shell, from ditto, ditto.
 - d.* Side view of adult shell, ditto, ditto.
 - e.* Front view of adult shell, Var. from Alum Bay, nat. size.
 - f.* Side view of the same, magnified.
 - g.* Front view of the same, magnified.
 3. *Voluta luctatrix*. No. 87, *p.* 147.

Back view, adult shell.
 4. *Marginella gracilis*. No. 82, *p.* 140.
 - a.* Front view, natural size.
 - b.* Front view, magnified.
 - c.* Side view, ditto.
 5. *Marginella ovulata*. No. 83, *p.* 141.
 - a.* Back view, natural size.
 - b.* Back view, magnified.
 - c.* Front view, ditto.
- Note.*—The posterior extremity of the outer lip is imperfect.
6. *Marginella pusilla*. No. 84, *p.* 143.
 - a.* Front view, natural size.
 - b.* Front view, magnified.
 - c.* Side view, ditto.
 7. *Marginella vittata*. No. 86, *p.* 144.
 - a.* Front view, natural size.
 - b.* Front view, magnified.
 - c.* Side view, ditto.
 8. *Marginella simplex*. No. 85, *p.* 143.
 - a.* Back view, natural size.
 - b.* Front view, magnified.
 - c.* Side view, ditto.



TAB. XIX.

Fig.

1. *Voluta nodosa*. No. 88, *p.* 148.

- a.* Back view of adult shell from Barton.
- b.* Front view of the same.
- c.* Back view of adult shell from Highgate.
- d.* Front view of ditto, ditto.
- e.* Back view of young shell from Bracklesham Bay.
- f.* Front view of adult shell, ditto.
- g.* Back view of ditto, ditto.
- h.* Front view of ditto, ditto.

Note.—Portions of the inner lip in the specimens, figs. 1*a* and 1*h*, are broken off.

2. *Voluta digitalina*, (Var. *lima*). No. 90, *p.* 151.

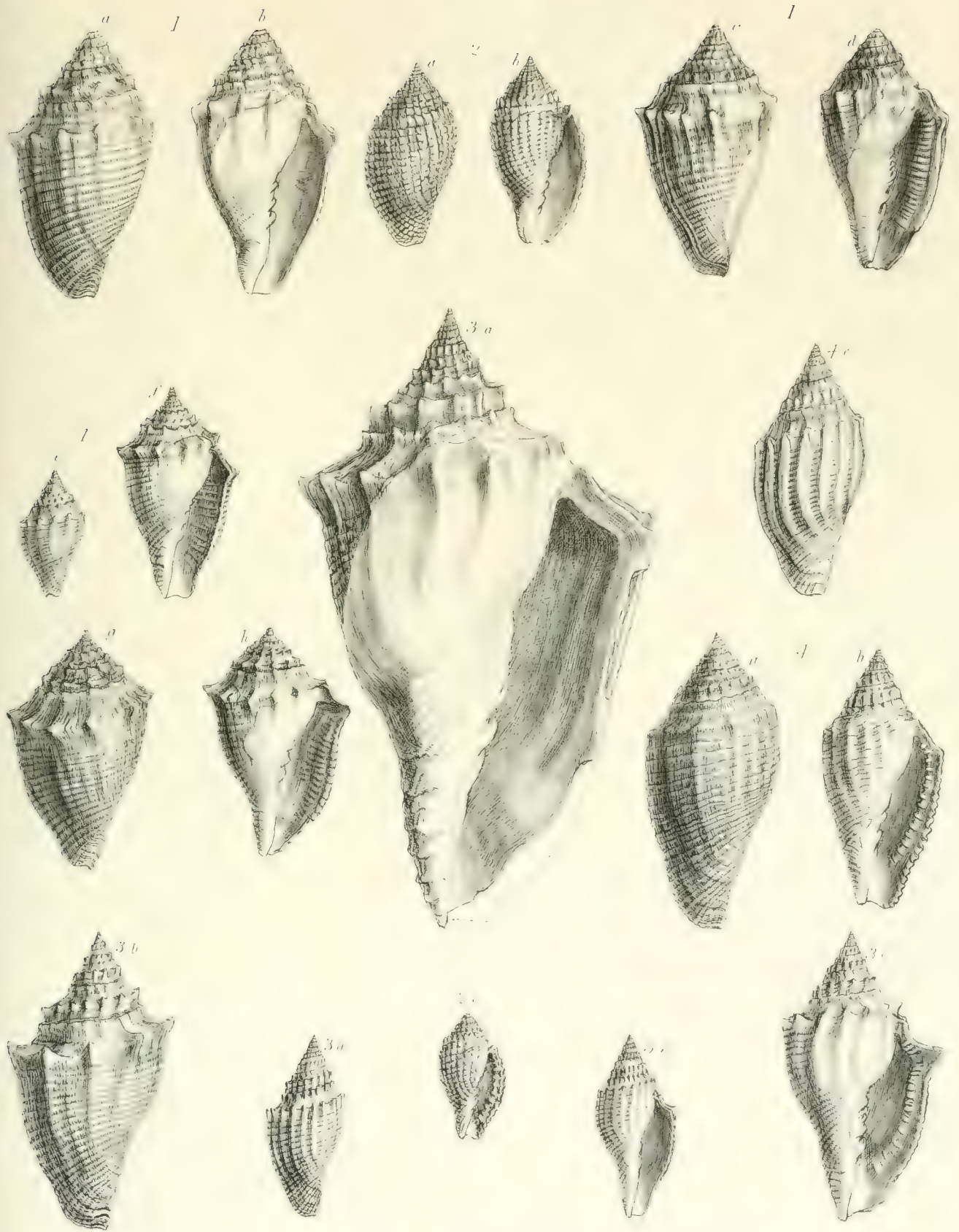
- a.* Back view, adult shell.
- b.* Front view, ditto.
- c.* Front view, ditto, with outer lip thickened and plicated.

3. *Voluta luctatrix*. No. 87, *p.* 147.

- a.* Front view, adult shell.
- b.* Back view, shell of mid-growth.
- c.* Front view, ditto.
- d.* Back view, young shell.
- e.* Front view, ditto.

4. *Voluta ambigua*. No. 89, *p.* 150.

- a.* Back view, adult shell.
- b.* Front view of the same.
- c.* Back view, (Var. *compressa*).



TAB. XX.

Fig.

1. *Voluta crenulata*. No. 92, *p.* 154.

a. Back view.

b. Front view.

2. *Voluta elevata*. No. 91, *p.* 153.

a. Back view, young shell.

b. Back view, adult shell.

c. Back view, adult shell from Southampton.

d. Front view of the same.

3. *Voluta recticosta*. No. 95, *p.* 157.

Back view.

4. *Voluta suspensa*. No. 96, *p.* 158.

a. Front view, young shell.

b. Back view, shell of mid-growth.

c. Front view, ditto.

d. Back view, adult shell.

5. *Voluta scalaris*. No. 94, *p.* 156.

a. Back view, shell from Highcliff.

b. Back view, shell from Barton.

c. Front view, ditto.

6. *Voluta Solandri*. No. 93, *p.* 155.

a. Back view, shell of mid-growth.

b. Front view, ditto.

c. Back view, adult shell.

d. Front view, ditto.

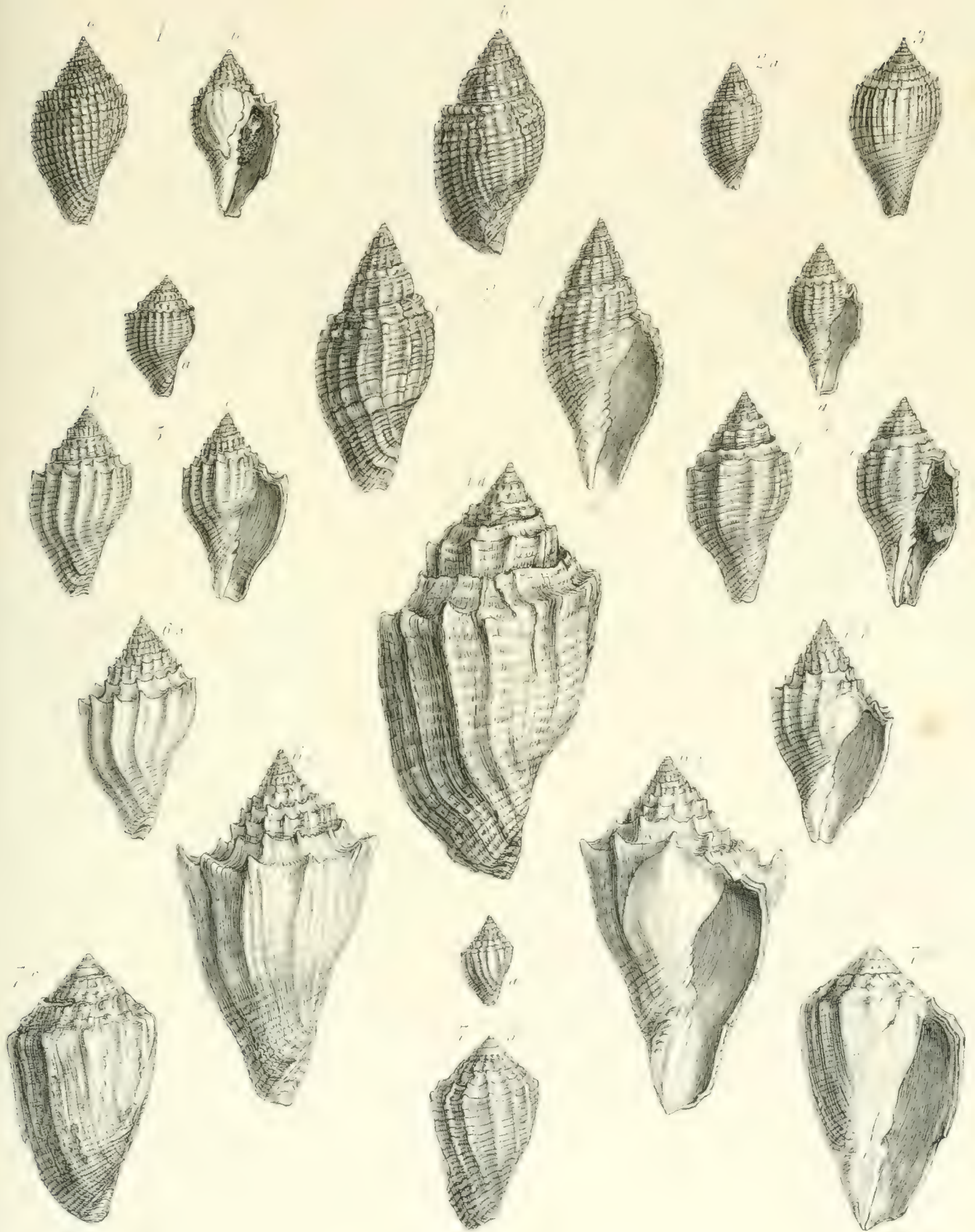
7. *Voluta tricornata*. No. 97, *p.* 159.

a. Back view, young shell from Primrose Hill.

b. Back view, shell of mid-growth from ditto.

c. Back view, adult shell from Copenhagen Fields.

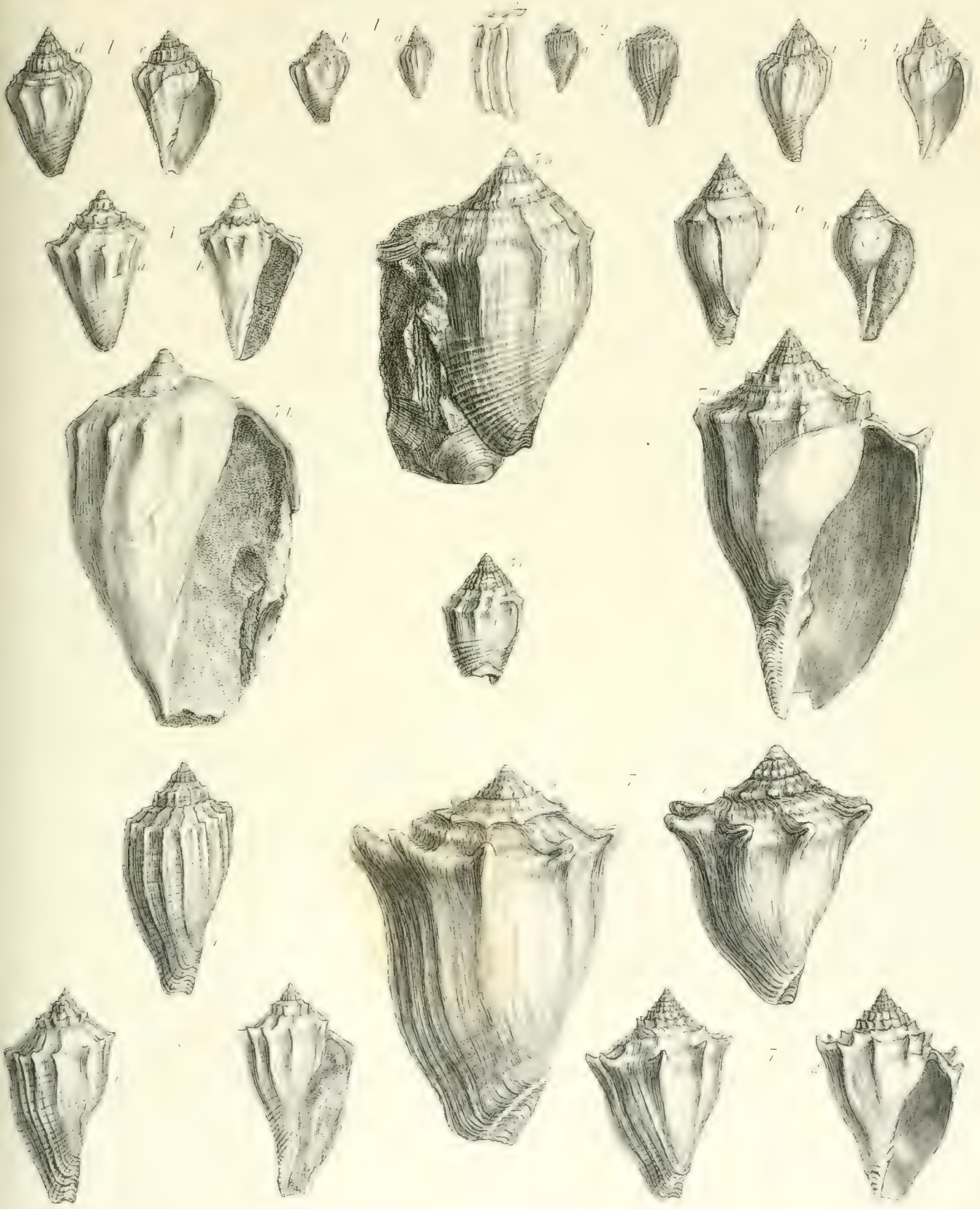
d. Front view, adult shell from Potter's Bar.



TAB. XXI.

Fig.

1. *Voluta Forbesii*. No. 105, *p.* 166.
 - a.* Back view, young shell, natural size.
 - b.* Back view, adult shell, ditto.
 - c.* Front view of the same, magnified.
 - d.* Back view, ditto, ditto.
2. *Voluta horrida*. No. 104, *p.* 166.
 - a.* Back view, natural size.
 - b.* Back view, magnified.
 - c.* Ribs, magnified.
3. *Voluta geminata*. No. 103, *p.* 165.
 - a.* Back view, adult shell.
 - b.* Front view, ditto.
4. *Voluta spinosa*. No. 101, *p.* 162.
 - a.* Back view.
 - b.* Front view.
5. *Voluta denudata*. No. 100, *p.* 162.
 - a.* Back view, shell of mid-growth.
 - b.* Front view, adult shell.
 - c.* Back view, young shell.
6. *Voluta calva*. No. 106, *p.* 167.
 - a.* Back view, adult shell.
 - b.* Front view, shell of mid-growth.
7. *Voluta athleta*. No. 99, *p.* 161.
 - a.* Front view, adult shell from Barton.
 - b.* Back view, ditto, ditto.
 - c.* Back view, shell of mid-growth, ditto.
 - d.* Front view of the same.
 - e.* Back view (Var. *Fortis*), adult shell from Highcliff.
8. *Voluta depauperata*. No. 102, *p.* 164.
 - a.* Back view, adult shell from Barton.
 - b.* Back view, ditto from Colwell Bay.
 - c.* Front view, ditto, ditto.



TAB. XXII.

Fig.

1. *Voluta pugil*. No. 98, *p.* 159.

- a.* Back view.
- b.* Front view.
- c.* Back view, (Var. *platyspina*).

2. *Voluta maga*. No. 111, *p.* 172.

- a.* Back view, young shell described in Min. Con., as to *V. harpula*.
- b.* Front view of the same.
- c.* Back view, young shell.
- d.* Front view, shell of mid-growth (*V. Magorum* of Sow.).
- e.* Front view, adult shell.
- f.* Back view of the same.

3. *Voluta Selseiensis*. No. 107, *p.* 168.

- a.* Back view, young shell (*V. bulbula* of Sow.).
- b.* Back view, ditto.
- c.* Front view, shell of mid-growth.
- d.* Back view of the same.
- e.* Front view, adult shell (*V. labrella* of Sow.).
- f.* Back view, ditto.

4. *Voluta Branderi*. No. 112, *p.* 174.

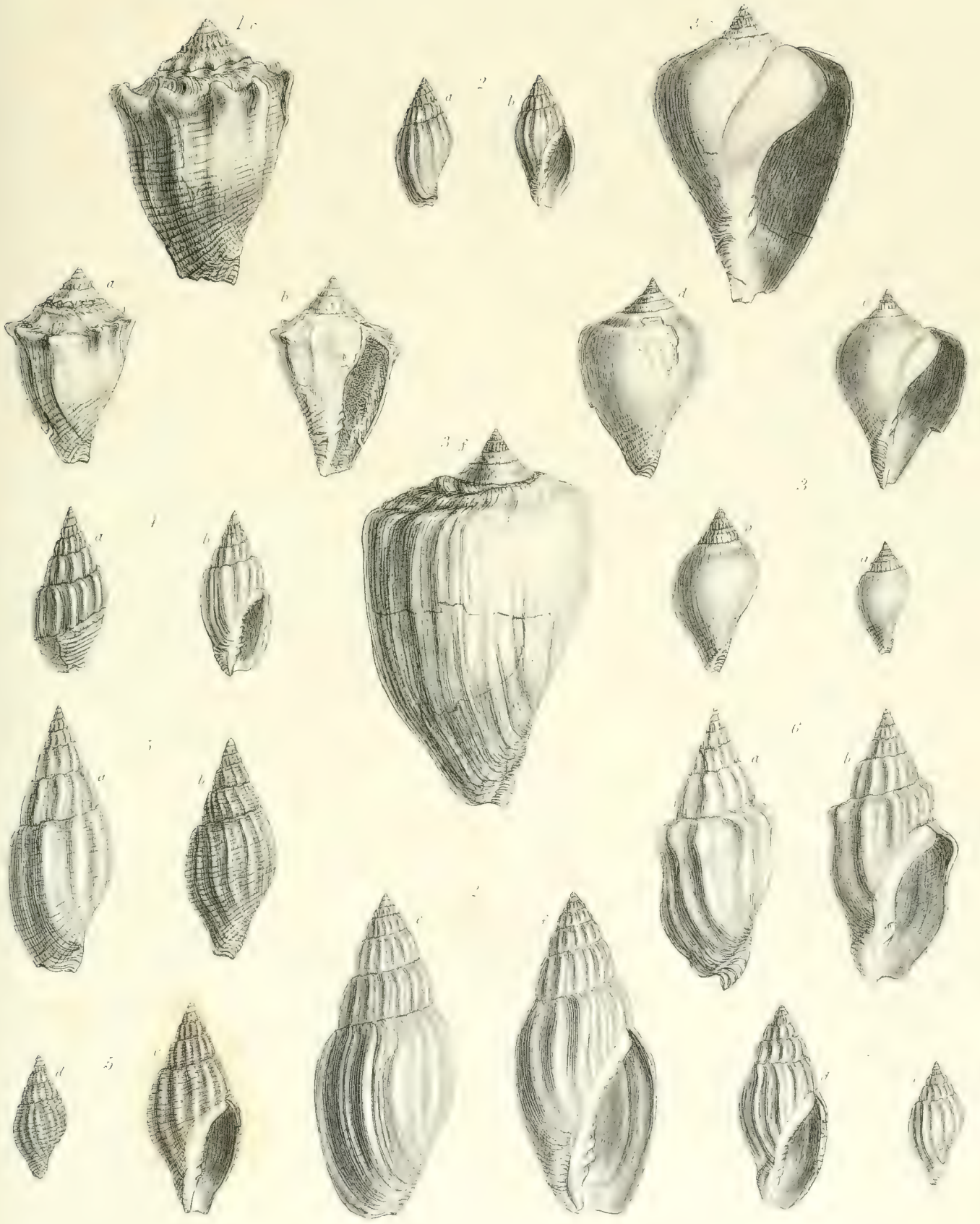
- a.* Back view, adult shell from Bracklesham Bay.
- b.* Front view, French specimen of mid-growth.

5. *Voluta costata*. No. 109, *p.* 170.

- a.* Back view, adult shell.
- b.* Back view, shell of mid-growth.
- c.* Front view of the same.
- d.* Back view, young shell.

6. *Voluta humerosa*. No. 110, *p.* 171.

- a.* Back view, adult shell.
- b.* Front view of the same.



TAB. XXIII.

Fig.

1. *Voluta muricina*. No. 116, *p.* 178.
 - a.* Back view, shell of mid-growth.
 - b.* Side view.
 - c.* Back view, adult shell

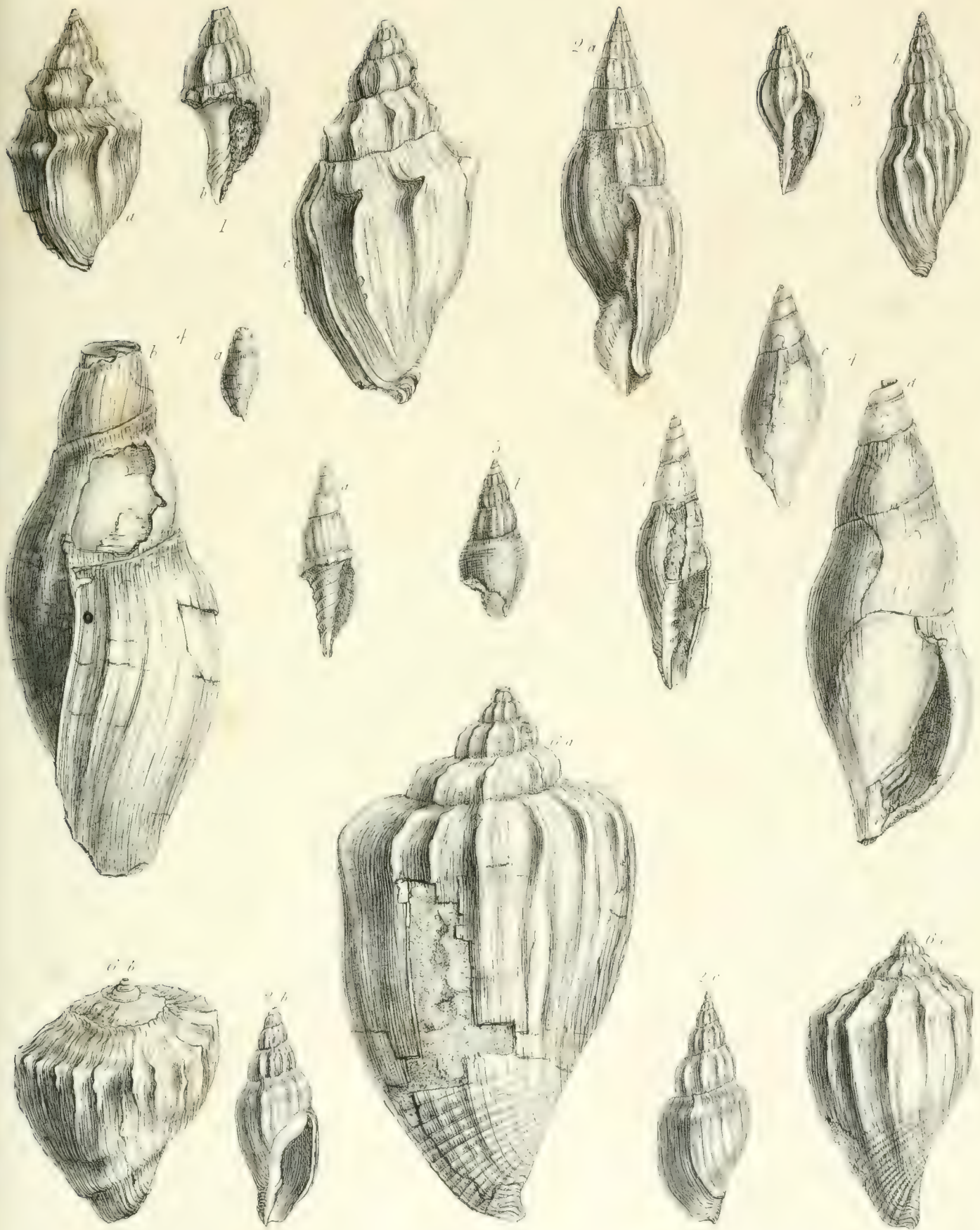
2. *Voluta uniplicata*. No. 115, *p.* 177.
 - a.* Side view, adult shell.
 - b.* Front view, shell of mid-growth.
 - c.* Back view, ditto.

3. *Voluta angusta*. No. 108, *p.* 169.
 - a.* Front view, young shell.
 - b.* Back view, adult shell.

4. *Voluta Wetherellii*. No. 117, *p.* 179.
 - a.* Back view, young shell with the pullus.
 - b.* Side view, adult shell.
 - c.* Back view, young shell.
 - d.* Front view, adult shell.

5. *Voluta protensa*. No. 113, *p.* 175.
 - a.* Side view, shell from Whetstone.
 - b.* Back view, ditto.
 - c.* Front view, adult shell from Potter's Bar.

6. *Voluta cithara*. No. 114, *p.* 176.
 - a.* Back view, adult shell.
 - b.* Back view, (Var. *angulata*).
 - c.* Back view, shell of mid-growth.





TAB. XXIV.

Fig.

1. *Mitra parva*, No. 120, *p.* 183.
 - a.* Back view, natural size.
 - b.* Back view, magnified.
 - c.* Front view, ditto.
2. *Mitra parva* (var. *pumila*). No. 120, *p.* 183.
 - a.* Back view, natural size.
 - b.* Back view, magnified.
 - c.* Front view, ditto.
3. *Mitra labratula*. No. 119, *p.* 182.
 - a.* Back view.
 - b.* Front view.
4. *Mitra obesa*. No. 122, *p.* 185.
 - a.* Back view, natural size.
 - b.* Back view, magnified.
 - c.* Front view, natural size.
 - d.* Front view, magnified.
5. *Mitra volutiformis*. No. 123, *p.* 186.
 - a.* Back view, natural size.
 - b.* Back view, magnified.
 - c.* Front view, ditto.
6. *Mitra scabra*, No. 118, *p.* 181.
 - a.* Front view, shell of mid-growth.
 - b.* Front view, adult shell.
 - c.* Back view, ditto.
7. *Mitra porrecta*. No. 121, *p.* 185.
 - a.* Front view, natural size.
 - b.* Front view, magnified.
 - c.* Back view, ditto.
8. *Conus diadema*. No. 124, *p.* 190.
 - a.* Back view, shell of mid-growth.
 - b.* Back view, adult shell.
 - c.* Front view, ditto.
 - d.* Back view, ditto. (Var. *pyriformis*.)
9. *Conus scabriculus*. No. 129, *p.* 198.
 - a.* Front view.
 - b.* Back view.
 - c.* Side view.

TAB. XXIV (*continued*).

Fig.

10. *Conus lineatus*. No. 130, *p.* 199.

a. Front view, natural size.

b. Front view, magnified.

c. Front view, (specimen described as *C. corculum*, Sow.)

11. *Conus dormitor*. No. 131, *p.* 200.

a. Side view.

b. Front view.

c. Back view.

12. *Conus velatus*. No. 126, *p.* 193.

Back view.

13. *Conus concinnus*. No. 128, *p.* 196.

a. Front view, shell of mid-growth.

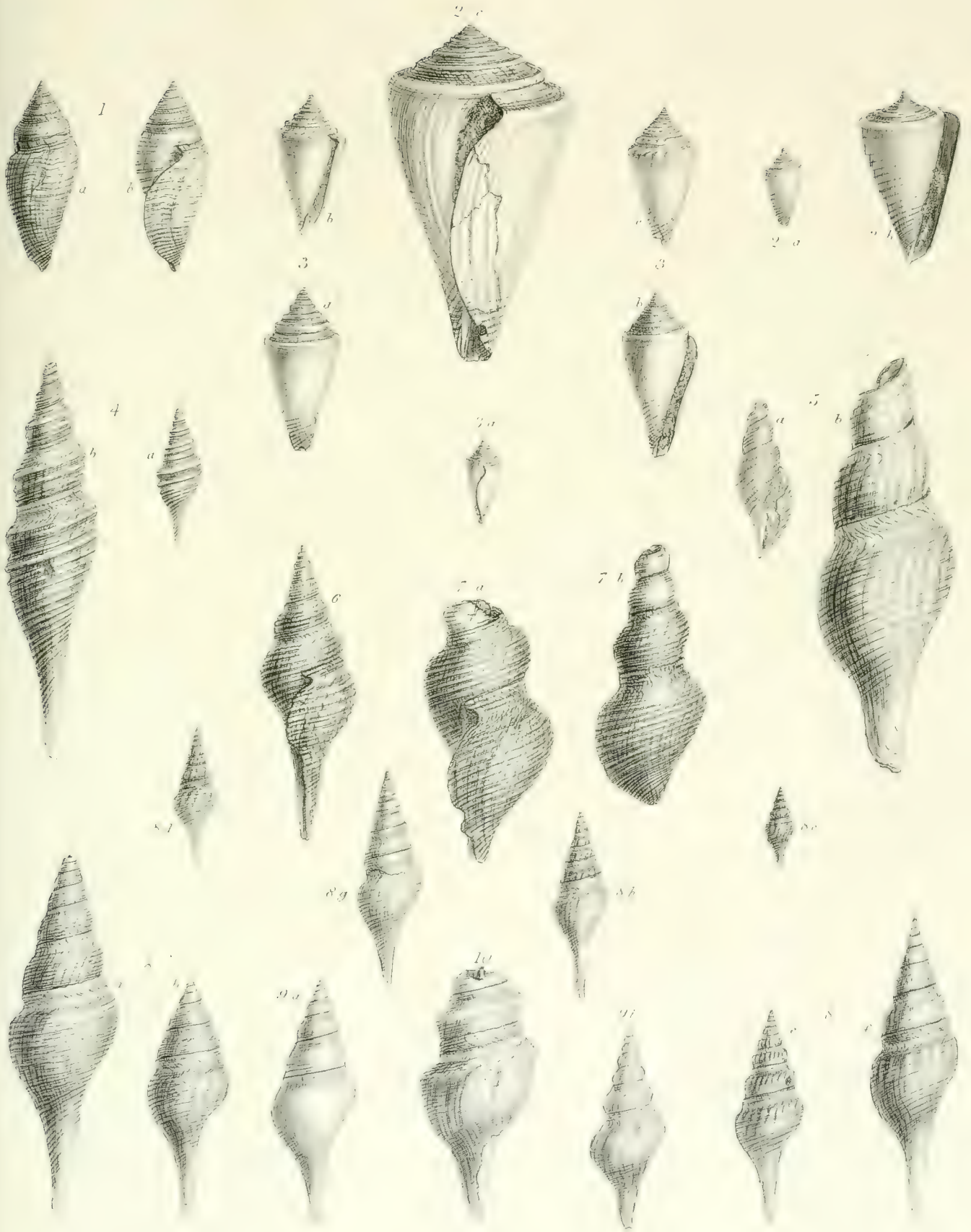
b. Back view, adult shell.

c. View from above, showing the posterior margins of the whorls forming the spire.



Fig.

1. *Conus alatus*. No. 132, *p.* 202.
 - a.* Back view.
 - b.* Side view.
2. *Conus deperditus*. No. 125, *p.* 191.
 - a.* Back view, young shell.
 - b.* Front view, shell of mid-growth.
 - c.* Side view, adult shell.
3. *Conus Lamarekii*. No. 127, *p.* 194.
 - a.* Side view, young shell, from Bracklesham Bay.
 - a.*.* Back view, adult shell, from ditto.
 - b.* Front view, adult shell, from ditto.
 - b.*.* Front view, adult shell, from Bramshaw.
 - c.* Back view, adult shell, from ditto.
4. *Pleurotoma stena*. No. 133, *p.* 207.
 - a.* Back view, young shell, from Southampton.
 - b.* Back view, adult shell, from Highgate.
5. *Pleurotoma symmetrica*. No. 136, *p.* 209.
 - a.* Front view, young shell, from Highgate.
 - b.* Back view, adult shell, from Southampton.
6. *Pleurotoma inarata*. No. 134, *p.* 208.
 - Side view, adult shell.
7. *Pleurotoma helix*. No. 135, *p.* 209.
 - a.* Side view, adult shell.
 - b.* Side view, shell of mid-growth.
8. *Pleurotoma teretrium*. No. 137, *p.* 210.
 - a.* Back view, adult shell, from Highgate.
 - b.* Back view, adult shell, from ditto. (Var. *nanodis*.)
 - c.* Back view, young shell, from Southampton. (Var. *tuberculata*.)
 - d.* Back view, young shell, from ditto. ditto.
 - e.* Back view, shell of mid-growth, from ditto.
 - f.* Back view, adult shell, from Highgate. (Var. *crebrilinea*.)
 - g.* Back view, Highgate specimen. (Var. *latimarginata*.)
 - h.* Back view, ditto. ditto.
9. *Pleurotoma transversaria*. No. 141, *p.* 214.
 - a.* Back view, Brockenhurst specimen.
 - b.* Back view, Lyndhurst specimen. (Var. *cypha*.)
10. *Pleurotoma gonizæa*. No. 140, *p.* 213.
 - Back view.



TAB. XXVI.

Fig.

1. *Pleurotoma crassa*. No. 138, *p.* 212.
 - a.* Back view, young shell, from Southampton.
 - b.* Back view, shell of mid-growth, from Shenfield.
 - c.* Back view, ditto, from Shenfield.
 - d.* Back view, adult shell, from Nuneham.
2. *Pleurotoma cocciphora*. No. 143, *p.* 217.

Back view, adult shell.
3. *Pleurotoma planetica*. No. 139, *p.* 212.

Back view, shell of nearly full growth, from Bramshaw.
4. *Pleurotoma cymæa*. No. 142, *p.* 215.
 - a.* Back view, shell of mid-growth, from Brockenhurst.
 - b.* Back view, adult shell, from ditto.
5. *Pleurotoma dentata*. No. 146, *p.* 220.

Back view.
6. *Pleurotoma Keelei*. No. 145, *p.* 219.

Back view, nearly adult shell, from Shenfield.
7. *Pleurotoma textiliosa*. No. 147, *p.* 222.

Side view, shell from Bracklesham Bay.
8. *Pleurotoma rostrata*. No. 144, *p.* 218.
 - a.* Side view, shell past mid-growth, from Barton.
 - b.* Back view, adult shell, from ditto.
 - c.* Front view, adult shell, from Highcliff. (Var. *antiqua*.)
9. *Pleurotoma lævigata*. No. 152, *p.* 227.
 - a.* Side view, shell of mid-growth, from Barton.
 - b.* Back view, adult shell, from ditto.
10. *Pleurotoma crassicosta*. No. 150, *p.* 225.
 - a.* Front view, adult shell.
 - b.* Back view, ditto.
11. *Pleurotoma lanceolata*. No. 151, *p.* 226.
 - a.* Front view, adult shell.
 - b.* Back view, ditto.
12. *Pleurotoma exorta*. No. 148, *p.* 223.
 - a.* Side view, adult shell.
 - b.* Back view, ditto.
13. *Pleurotoma macilenta*. No. 149, *p.* 224.
 - a.* Front view, adult shell, from Barton.
 - b.* Back view, adult shell, from ditto.



TAB. XXVII.

Fig.

1. *Pleurotoma fusiformis*. No. 153, *p.* 228.
 - a.* Back view.
 - b.* Front view.
2. *Pleurotoma sulculosa*. No. 154, *p.* 229.
 - a.* Back view, young shell, from Potters' Bar.
 - b.* Back view, shell of mid-growth, from ditto.
 - c.* Back view, adult shell, from Highgate.
3. *Pleurotoma acuminata*. No. 155, *p.* 230.
 - a.* Back view, adult shell, from Highgate.
 - b.* Front view, adult shell, from ditto.
 - c.* Front view, adult shell, from Hornsey, smooth variety.
 - d.* Front view, adult shell, from Clarendon Hill.
4. *Pleurotoma microdonta*. No. 158, *p.* 236.
 - Side view, adult shell, from Highcliff.
5. *Pleurotoma desmia*. No. 161, *p.* 240.
 - Front view, shell nearly adult.
6. *Pleurotoma pyrulata*. No. 156, *p.* 232.
 - a.* Back view, adult shell.
 - b.* Side view, ditto.
7. *Pleurotoma attenuata*. No. 159, *p.* 232.
 - a.* Side view, shell nearly adult.
 - b.* Side view, adult shell.
 - c.* Back view, shell of mid-growth.
8. *Pleurotoma conica*. No. 160, *p.* 239.
 - a.* Back view, adult shell.
9. *Pleurotoma cymæa*. No. 142, *p.* 215.
 - a.* Back view, young shell, from Colwell Bay.
10. *Pleurotoma terebralis*, *var.* No. 157. *p.* 233.
 - a.* Back view, shell magnified (*var. ditropis*), from Hampstead.
 - b.* Back view, shell magnified (*var. gyrata*), from Hornsey.
 - c.* Back view, shell natural size (*var. gyrata*), from Shenfield.
 - d.* Back view, shell magnified (*var. gyrata*), from Southampton.
 - e.* Back view, shell magnified (*var. pulcherrima*), from Highgate.
 - f.* Back view, shell natural size (*var. revoluta*), from Clarendon Hill.
 - g.* Back view, shell magnified (*var. pulcherrima*), from ditto.
 - h.* Back view, shell natural size (*var. Pagoda*), from ditto.
 - i.* Front view, shell natural size (*var. concinna*), from Potters' Bar.
 - k.* Front view, shell magnified (*var. concinna*), from Highgate.

NOTE.—The lines indicate the size of the specimens.



TAB. XXVIII.

NOTE.—*The lines indicate the actual dimensions of the specimens.*

Fig.

1. *Pleurotoma innexa*. No. 162, *p.* 241.
 - a.* Side view of young shell, nat. size; from Barton.
 - b.* Ditto of adult shell, nat. size.
 - c.* Ditto of body-whorl, magnified.
2. *Pleurotoma turpis*. No. 189, *p.* 267.
 - a.* Side view, nat. size; from Clarendon.
 - b.* Ditto of body-whorl, magnified.
 - c.* Back view, nat. size.
3. *Pleurotoma inflexa*. No. 163, *p.* 242.
 - a.* Front view, nat. size; from Bracklesham Bay.
 - b.* Back view, ditto; from Bramshaw.
 - c.* Side view of body-whorl, magnified.
4. *Pleurotoma granulata*. No. 186, *p.* 264.
 - a.* Back view, magnified; from Highcliff.
 - b.* Front view, ditto.
 - c.* Side view of body-whorl, magnified.
5. *Pleurotoma lissa*. No. 191, *p.* 268.
 - a.* Back view, magnified; from Potter's Bar.
 - b.* Front view, ditto.
6. *Pleurotoma tricineta*. No. 174, *p.* 252.
 - a.* Back view, magnified; from Potter's Bar.
 - b.* Ditto of body-whorl and part of the spire, magnified.
7. *Pleurotoma dissimilis*. No. 167, *p.* 246.
 - a.* Side view, magnified; from Highcliff.
 - b.* Front view, ditto.
 - c.* Ditto of body-whorl, magnified.
8. *Pleurotoma microcheila*. No. 166, *p.* 245.
 - a.* Back view, magnified; from Highcliff.
 - b.* Front view, magnified.
 - c.* Side view of body-whorl, and part of the spire, magnified.
 - d.* Front view, magnified (var. *producta*); from Highcliff.
 - e.* Back view, magnified (ditto).
 - f.* Front view of body whorl, magnified (ditto).

Fig.

9. *Pleurotoma pupa*. No. 175, *p.* 253.
 a. Side view, magnified; from Highcliff.
 b. Ditto of body-whorl, magnified.
 c. Front view, magnified.
10. *Pleurotoma lepta*. No. 164, *p.* 244.
 a. Side view, magnified; from Stubbington.
 b. Ditto of body-whorl, magnified.
 c. Back view, magnified.
11. *Pleurotoma plicata*. No. 169, *p.* 248.
 a. Front view, nat. size; from Bramshaw.
 b. Ditto of body-whorl, and part of the spire, magnified.
 c. Back view, nat. size.
12. *Pleurotoma coarctata*. No. 165, *p.* 245.
 a. Back view, magnified; from Highcliff.
 b. Front view, ditto.
 c. Side view of body-whorl, magnified.
13. *Pleurotoma gomphoidea*. No. 168, *p.* 247.
 a. Back view, nat. size; from Highcliff.
 b. Front view, ditto.
 c. Ditto of body-whorl, and part of the spire, magnified.
 d. Back view, nat. size; from Clarendon.
 e. Ditto of body-whorl, magnified.
 *f*1. Front view (var. *avita*), nat. size; from Southampton.
 *f*2. Ditto (ditto) magnified.
14. *Pleurotoma acuticosta*. No. 170, *p.* 249.
 a. Back view, nat. size; from Barton.
 b. Front view, ditto.
 c. Ditto of body-whorl, and part of the spire, magnified.
15. *Pleurotoma dilinum*. No. 173, *p.* 252.
 a 1. Front view, magnified; from Alum Bay (Strat. No. 29, Prestw.)
 a 2. Side view, magnified.
 b. Ditto of body-whorl, magnified.
16. *Pleurotoma pyrgota*. No. 179, *p.* 257.
 a. Back view, nat. size; from Bramshaw.
 b. Front view, ditto.
 c. Ditto of body-whorl, and part of the spire, magnified.
17. *Pleurotoma Headonensis*. No. 187, *p.* 265.
 a. Back view, magnified; from Headon Hill.
 b. Ditto of body-whorl, and part of the spire, magnified.
 c. Front view, magnified.



TAB. XXIX.

NOTE.—*The lines indicate the actual dimensions of the specimens.*

Fig.

1. *Pleurotoma constricta*. No. 178, *p.* 256.
 - a.* Side view, natural size ; from Barton.
 - b.* Ditto of body-whorl, magnified.
 - c.* Front view, nat. size.
2. *Pleurotoma scabriuscula*. No. 176, *p.* 254.
 - a.* Back view, magnified ; from Highcliff.
 - b.* Side view, ditto.
 - c.* Ditto, ditto.
3. *Pleurotoma verticillum*. No. 177, *p.* 255.
 - a.* Back view, nat. size ; from Barton.
 - b.* Ditto of body-whorl, and part of the spire, magnified.
 - c.* Front view, nat. size.
4. *Pleurotoma turgidula*. No. 172, *p.* 251.
 - a.* Back view, nat. size ; from Alum Bay (Strat. No. 29, Prestw.?)
 - b.* Side view, ditto.
 - c.* Ditto of the body-whorl, magnified.
5. *Pleurotoma tereticosta*. No. 171, *p.* 250.
 - a.* Back view, nat. size ; from Highgate.
 - b.* Ditto, magnified.
 - c.* Ditto, (var. *soror*), nat. size ; from Southampton.
 - d.* Ditto, (ditto) magnified.
6. *Pleurotoma brevirostrum*. No. 180, *p.* 258.
 - a.* Back view, nat. size ; from Muddiford? (*Mus. Sow.*)
 - b.* Front view, ditto.
7. *Pleurotoma nodulosa*. No. 181, *p.* 260.
 - a.* Back view, nat. size ; from Stubbington.
 - b.* Front view, ditto.
 - c.* Side view, magnified.
8. *Pleurotoma nodosaria*. No. 182, *p.* 261.
 - a.* Back view, magnified ; from Southampton.
 - b.* Front view, ditto.

Fig.

9. *Pleurotoma bracheia*. No. 184, *p.* 263.
 - a.* Side view, magnified; from Barton.
 - b.* Ditto, ditto.
10. *Pleurotoma vicina*. No. 188, *p.* 266.
 - a.* Side view, magnified; from Alum Bay (Strat. No. 29, Prestw.)
 - b.* Front view, ditto.
11. *Pleurotoma undata*. No. 183, *p.* 261.
 - a.* Back view, nat. size; from Stubbington.
 - b.* Front view, ditto.
12. *Pleurotoma sindonata*. No. 185, *p.* 263.
 - a.* Side view, magnified; from Stubbington.
 - b.* Front view, ditto.
13. *Pleurotoma subula*. No. 190, *p.* 267.
 - a.* Back view, nat. size; from Basingstoke.
 - b.* Ditto, magnified.
14. *Pleurotoma aspera*. No. 197, *p.* 273.
 - a.* Back view, nat. size; from Barton.
 - b.* Side view, ditto; from Highcliff.
15. *Pleurotoma Koninckii*. No. 204, *p.* 279.
 - a.* Front view, nat. size; from Railway Tunnel, Hampstead.
 - b.* Back view, ditto.
16. *Pleurotoma Wetherellii*. No. 211, *p.* 285.
 - a* and *d.* Back views of young shells, nat. size; from Highgate.
 - b.* Back view of adult shell, ditto; (*Mus. Weth.*)
 - c.* Front view of ditto.
17. *Pleurotoma Selysii*. No. 203, *p.* 278.
 - a.* Front view of shell of mid-growth, nat. size; from Muswell Hill
(*Mus. Weth.*)
 - b.* Side view ditto, ditto.
 - c.* Back view of adult shell, nat. size (*Mus. Weth.*)
 - d.* Ditto of shell of mid-growth, ditto (*ditto*).



TAB. XXX.

NOTE.—*The lines indicate the actual dimensions of the specimens.*

Fig.

1. *Pleurotoma gentilis*. No. 205, *p.* 280.
 - a.* Front view, natural size ; from Bracklesham Bay.
 - b.* Back view, ditto.
 - c.* Part of the body-whorl, magnified.
2. *Pleurotoma comma*. No. 206, *p.* 281.

Front view, nat. size ; from Stubbington.
3. *Pleurotoma Prestwichii*. No. 207, *p.* 282.
 - a.* Back view, nat. size ; from Clarendon.
 - b.* Part of the body-whorl, magnified.
 - c.* Back view (var.), nat. size.
 - d.* Side view (var.), ditto.
4. *Pleurotoma simillima*. No. 208, *p.* 283.
 - a.* Back view, nat. size ; from Clarendon.
 - b.* Side view, ditto.
 - c.* Part of the body-whorl, magnified.
5. *Pleurotoma mixta*. No. 201, *p.* 277.
 - a.* Back view, nat. size ; from Barton.
 - b.* Front view, ditto.
6. *Pleurotoma crebrilinea*. No. 214, *p.* 290.
 - a.* Back view, nat. size ; from Stubbington.
 - b.* Front view, ditto.
 - c.* Part of the body-whorl, magnified.
7. *Pleurotoma denticula*. No. 213, *p.* 286.
 - a.* Back view, nat. size ; from Bracklesham Bay.
 - b.* Part of the body-whorl, magnified.
 - c.* Back view, nat. size ; from Barton.
 - d.* Ditto (var. *longæva*), nat. size ; from Highgate.
 - e.* Ditto (var. *macrobia*), ditto ; from Clarendon.
 - f.* Ditto (var. *gracilentia*), ditto ; from Brook, in the New Forest.
 - g.* Side view (var. *conulus*), ditto ; from Barton.
 - h.* Back view (var. *odontella*), ditto ; from Colwell Bay.

Fig.

8. *Pleurotoma Waterkeynii*. No. 200, *p.* 275.
 - a.* Front view, nat. size ; from Potter's Bar.
 - b.* Back view, ditto.
 - c.* Part of the body-whorl, magnified.
9. *Pleurotoma callifera*. No. 215, *p.* 291.
 - a.* Front view, magnified ; from Highcliff.
 - b.* Side view, ditto.
10. *Pleurotoma callifera*, var. *monilifera*. No. 215, *p.* 291.
 - a.* Back view, nat. size ; from Barton.
 - b.* Front view, ditto.
11. *Pleurotoma callifera*, var. *raphium*. No. 215, *p.* 291.
 - a.* Back view, magnified ; from Highcliff.
 - b.* Side view, ditto.
12. *Pleurotoma fasciolata*. No. 212, *p.* 286.
 - a.* Back view, shell of mid-growth, nat. size ; from Highgate.
 - b.* Front view, adult shell, ditto ; from Railway Cutting, at Kilburn.
13. *Pleurotoma tæniolata*. No. 210, *p.* 284.
 - a.* Back view, nat. size ; from Cuffell (*Mus. Prestw.*)
 - b.* Front view, ditto.
 - c.* Part of the body-whorl, ditto.
14. *Pleurotoma abnormis*. No. 218, *p.* 294.
 - a.* Back view, nat. size ; from Highgate.
 - b.* Front view, ditto.
15. *Pleurotoma Volgeri*. No. 199, *p.* 275.
 - a.* Back view, nat. size ; from Potter's Bar.
 - b.* Ditto, magnified.



TAB. XXXI.

NOTE.—*The lines indicate the actual dimensions of the specimens.*

Fig.

1. *Pleurotoma obscurata*. No. 220, *p.* 296.
 - a.* Front view of shell of mid-growth, nat. size ; from Bracklesham Bay
 - b.* Back view of adult shell, ditto.
2. *Pleurotoma curta*. No. 230, *p.* 305.
 - a.* Back view, magnified ; from Alum Bay (Strat. No. 29, Prestw.)
 - b.* Front view, ditto.
3. *Pleurotoma conifera*. No. 198, *p.* 274.
 - a.* Back view, nat. size ; from Bracklesham Bay.
 - b.* Front view, ditto ; from Bramshaw.
4. *Pleurotoma rotella*. No. 223, *p.* 299.
 - a.* Back view, magnified ; from Highcliff.
 - b.* Side view, ditto.
5. *Pleurotoma cedilla*. No. 224, *p.* 300.
 - a* and *b.* Back views, magnified ; from Barton.
6. *Pleurotoma scalarata*. No. 219, *p.* 295.
 - a.* Back view, nat. size ; from Bramshaw.
 - b.* Side view, ditto.
7. *Pleurotoma granata*. No. 234, *p.* 308.
 - a.* Front view, nat. size ; from Highgate.
 - b.* Back view, ditto.
 - c.* Part of the body-whorl, magnified.
8. *Pleurotoma Hantoniensis*. No. 240, *p.* 315.
 - a.* Back view, shell of mid-growth, nat. size ; from Lyndhurst.
 - b.* Side view, ditto, ditto ; from Brockenhurst.
 - c.* Front view, adult shell, ditto.

Fig.

9. *Pleurotoma rotundata*. No. 233, *p.* 307.

a. Front view, nat. size; from Highgate.

b. Front view, ditto; from Potter's Bar.

10. *Pleurotoma parilis*. No. 235, *p.* 309.

a. Side view, nat. size; from Highgate.

b. Part of the body-whorl, magnified.

c. Front view, nat. size.

11. *Pleurotoma variata*. No. 228, *p.* 303.

Front view, magnified; from Clarendon.

12. *Pleurotoma varians*. No. 217, *p.* 293.

a. Side view of young shell, magnified; from Highcliff.

b. Back view, adult shell, nat. size.

13. *Pleurotoma Lehonii*. No. 194, *p.* 271.

a. Back view, nat. size; from Highgate (*Mus. Weth.*)

b. Back view, magnified.

14. *Pleurotoma Fisheri*. No. 192, *p.* 269.

a. Front view, nat. size; from Brook (New Forest).

b. Back view, magnified.

15. *Pleurotoma puella*. No. 231, *p.* 305.

a. Front view, nat. size; from Barton.

b. Back view of the body-whorl, magnified.

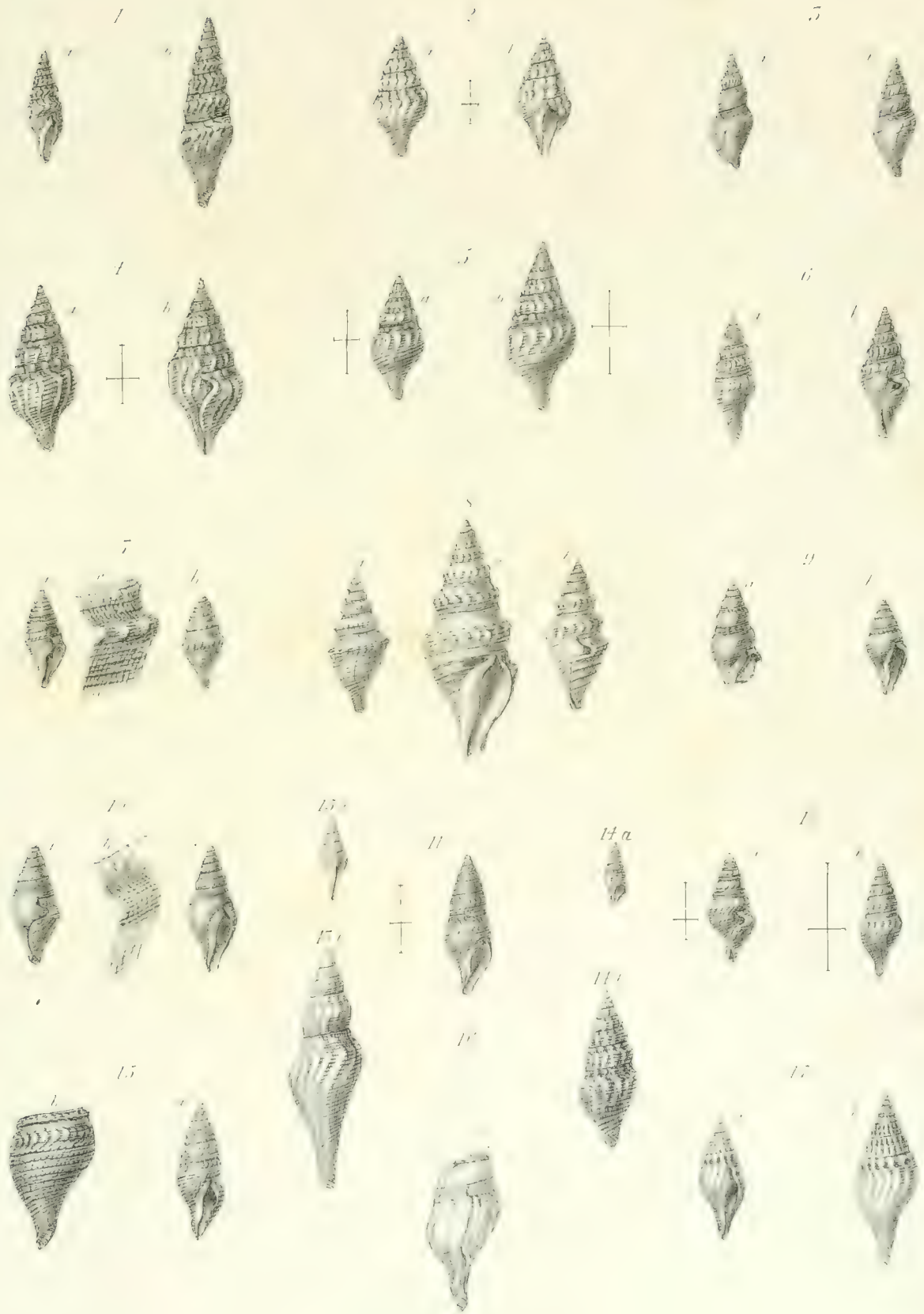
16. *Pleurotoma zeta*. No. 209, *p.* 284.

Back view, nat. size; from Bracklesham Bay.

17. *Pleurotoma divisa*. No. 202, *p.* 278.

a. Front view, shell of mid-growth, nat. size; from Bracklesham Bay.

b. Back view, adult shell, ditto.



TAB. XXXII.

NOTE—*The lines indicate the actual dimensions of the specimens.*

Fig.

1. *Pleurotoma monerma*. No. 216, *p.* 292.
 - a.* Back view, young shell, nat. size ; from Highcliff.
 - b.* Side view, adult shell, ditto.
 - c.* Part of the body-whorl, magnified.

2. *Pleurotoma turbida*. No. 237, *p.* 311.
 - a.* Side view, adult shell, nat. size ; from Barton.
 - b.* Back view, shell of mid-growth, nat. size.
 - c.* Side view, ditto ditto ; from Highcliff.

3. *Pleurotoma lima*. No. 221, *p.* 296.
 - a.* Side view, shell of mid-growth, nat. size ; from Barton.
 - b* and *c.* Back views, adult shells ; ditto.

4. *Pleurotoma reticulosa*. No. 222, *p.* 298.
 - a.* Side view of young shell, nat. size ; from Barton.
 - b.* Back view, adult shells, ditto.

5. *Pleurotoma acutisinuata*. No. 232, *p.* 306.
 - a.* Side view, nat. size ; from Bracklesham Bay.
 - b.* Outer lip, showing the sinus, magnified.

6. *Pleurotoma zonulata*. No. 241, *p.* 317.
 - a.* Back view, magnified ; from Barton.
 - b.* Side view, ditto.

7. *Pleurotoma helicoides*. No. 244, *p.* 319.
 - a.* Side view of young shell, magnified ; from Barton.
 - b.* Ditto of adult shell, ditto.

8. *Pleurotoma flexuosa*. No. 226, *p.* 302.
 - a.* Front view, nat. size ; from Shinfield (*Mus. Prestw.*)
 - b.* Back view, ditto, from Clarendon.
 - c.* Front view of the body-whorl of fig. *a*, magnified.

Fig.

9. *Pleurotoma læviuscula*. No. 236, *p.* 310.
 - a.* Back view, nat. size; from Brockenhurst.
 - b.* Ditto of the body-whorl, magnified.
10. *Pleurotoma Woodii*. No. 229, *p.* 304.
 - a.* Back view, magnified; from Headon Hill.
 - b.* Ditto, of the body-whorl, magnified.
11. *Pleurotoma pupoides*. No. 227, *p.* 302.
 - a.* Back view, nat. size; from Clarendon.
 - b.* Ditto of the body-whorl, magnified.
12. *Pleurotoma ligata*. No. 238, *p.* 313.
 - a.* Front view of shell of mid-growth, nat. size; from Bramshaw.
 - b.* Side view of adult shell, ditto.
13. *Pleurotoma hemileia*. No. 239, *p.* 314.
 - a.* Front view, nat. size; from Alum Bay (Strat. No. 29, Prestw.)
 - b.* Back view, ditto.
14. *Pleurotoma insignis*. No. 225, *p.* 301.
 - a.* Back view, magnified; from Alum Bay (Strat. No. 4, Prestw.)
 - b.* Part of the body-whorl, much magnified.



TAB. XXXIII.

NOTE.—*The lines indicate the actual dimensions of the specimens.*

Fig.

1. *Pleurotoma prisca*. No. 245, *p.* 320.
 - a.* Side view of adult shell, nat. size ; from Barton.
 - b.* Side view of young shell, ditto.
 - c.* Front view of adult shell, nat. size ; from Bramshaw.
 - d.* Front view ditto, ditto ; from Barton.
 - e.* Side view of shell of mid-growth, ditto ; from Bracklesham Bay.
2. *Pleurotoma amphiconus*. No. 246, *p.* 322.
 - a.* Side view of shell of mid-growth, nat. size ; from Bracklesham Bay.
 - b.* Back view of adult shell, ditto.
3. *Pleurotoma semistriata*. No. 247, *p.* 323.
 - a.* Back view, nat. size ; from Bramshaw.
 - b.* Front view, ditto.
4. *Pleurotoma glabrata*. No. 248, *p.* 324.

Front view, nat. size ; from Bracklesham Bay.
5. *Pleurotoma conoides*. No. 242, *p.* 317.
 - a.* Back view of adult shell, nat. size ; from Barton.
 - b.* Side view of shell of mid-growth ; ditto.
6. *Pleurotoma cochlis*. No. 196, *p.* 272.

Back view of adult shell, nat. size ; from Shinfield (*Mus. Prestw.*)
7. *Pleurotoma biconus*. No. 243, *p.* 318.
 - a.* Back view of adult shell, magnified ; from Highcliff.
 - b.* Side view, ditto.
8. *Pleurotoma macrura*. No. 195, *p.* 271.
 - a.* Back view of shell in the matrix, nat. size ; from Finchley.
 - b.* Part of the body-whorl, magnified.

Fig.

9. *Pleurotoma Tallavignesii*. No. 193, *p.* 270.

a. Side view of young shell, magnified; from Nuneham.

b. Back view of adult shell, nat. size; from Southend (*Mus. Prestw.*)

10. *Metula juncea*.

a. Back view, nat. size; from Barton.

b. Side view, ditto.

c. Front view, ditto.

11. *Borsonia Biaritzana*. No. 249, *p.* 327.

a. Front view, nat. size; from Bramshaw.

b. Back view, ditto; from Bracklesham Bay.

The specimen represented by fig. 11, *b*, is that figured and described in Dixon's 'Geology, &c., of Sussex,' as *Fasciolaria biplicata*.

12. *Borsonia sulcata*. No. 250, *p.* 328.

a. Front view, magnified; from Colwell Bay.

b. Back view, ditto.

13. *Borsonia semicostata*. No. 251, *p.* 329.

a. Front view, magnified; from Barton.

b. Side view, ditto.

14. *Borsonia lineata*. No. 252, *p.* 330.

a. Front view, magnified; from Highcliff.

b. Side view, ditto.

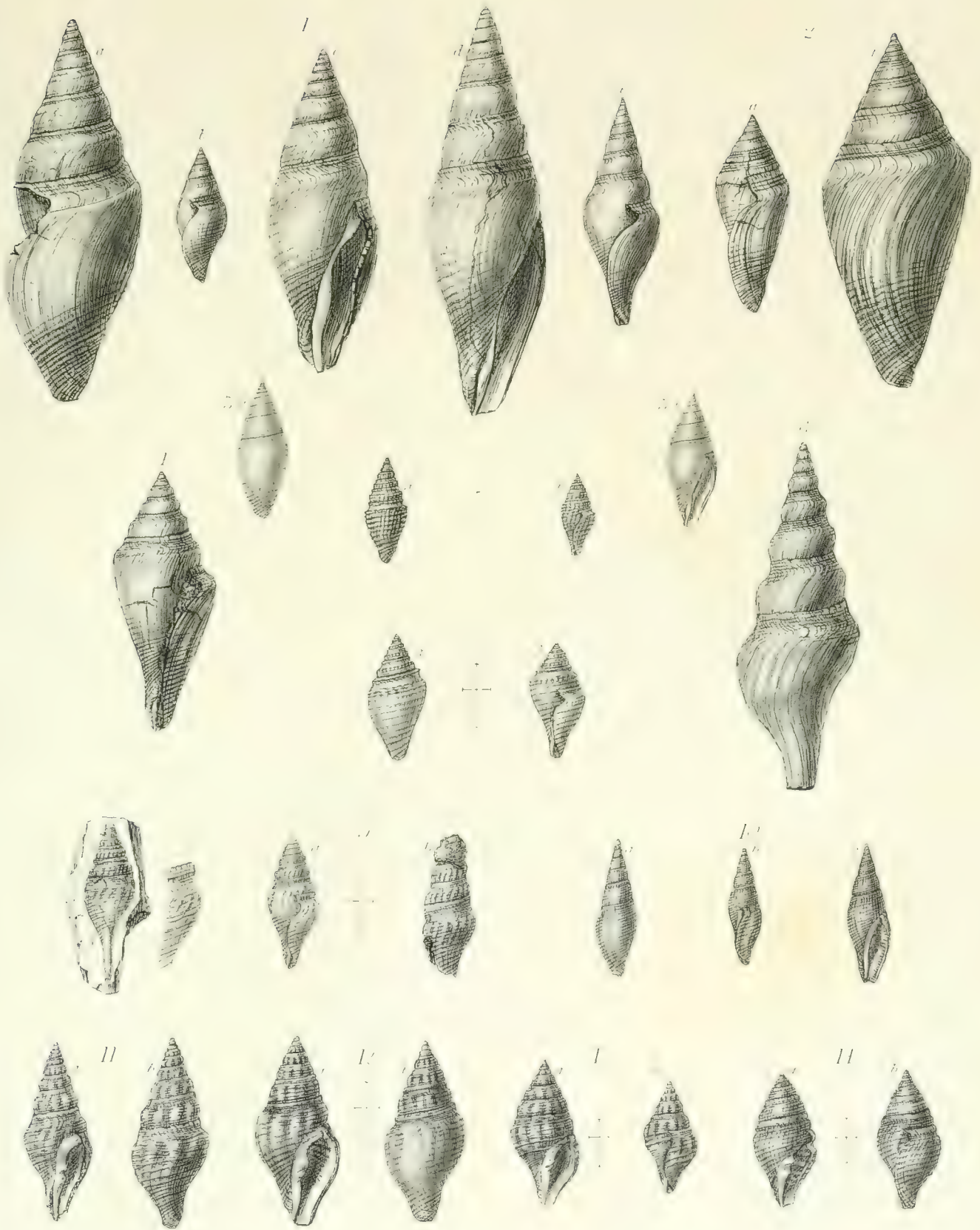


PLATE XXXIV.

NOTE.—*The lines indicate the actual dimensions of the specimens.*

FIG.

- 1, *a, b.* Planorbis lævigatus, No. 262, *p.* 340. Dulwich.
- 2, *a—d.* Cyclostoma? mumia, No. 254, *p.* 332. Sconce.
- 3, *a—c.* Callia? lævis, No. 255, *p.* 333. Sconce.
- 4, *a, b.* Pomatias lamellosus, No. 256, *p.* 334. Headon Hill.
- 5, *a, b.* Helix Morrisii, No. 253, *p.* 331. Sconce.
6. Bulimus convexus, No. 258, *p.* 335. Sconce.
- 7, *a, b.* „? Vectiensis, No. 259, *p.* 336. Sconce.
- 8, *a, b.* Bythinia conica? No. 261, *p.* 338. Headon Hill.
- 9, *a, b.* Bulimus Rillyensis, No. 257, *p.* 334. Dulwich.
10. Limnæa elongata, No. 263, *p.* 341. Hordle.
- 10⁺. Succinea Sparnacensis? No. 260, *p.* 336. Headon Hill.
11. Limnæa stagnalis, *p.* 341. Recent.
- 12, *a, b.* Neritina tristis, No. 269, *p.* 347. Hempstead.
- 13, *a, b.* „ consobrina, No. 265, *p.* 344. Peckham.
- 14, *a—c.* „ concava, No. 268, *p.* 346. Headon Hill.
- 15, *a, b.* „ vicina? No. 266, *p.* 344. Charlton.
- 16, *a—c.* „ Forbesii, No. 271, *p.* 348. Headon Hill.
- 17, *a—c.* „ jaspidea? No. 267, *p.* 345. Dulwich.
- 18, *a, b.* „ globulus, No. 264, *p.* 343. Peckham.
19. „ zonula, No. 272, *p.* 348. Headon Hill.
- 20, *a, b.* „ aperta, No. 270, *p.* 347. Headon Hill.
- 21, *a, b.* „ planulata, No. 273, *p.* 349. Headon Hill.
- 22, *a, b.* Nerita tricarinata, No. 274, *p.* 349. Bracklesham.



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